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No. CLXXIV

THE VEGETATION OF THE GRENADINES, WINDWARD ISLANDS, BRITISH WEST INDIES

By

Richard A. Howard

Published by
THE GRAY HERBARIUM OF HARVARD UNIVERSITY
CAMBRIDGE, MASS., U. S. A.
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Issued June 30, 1952

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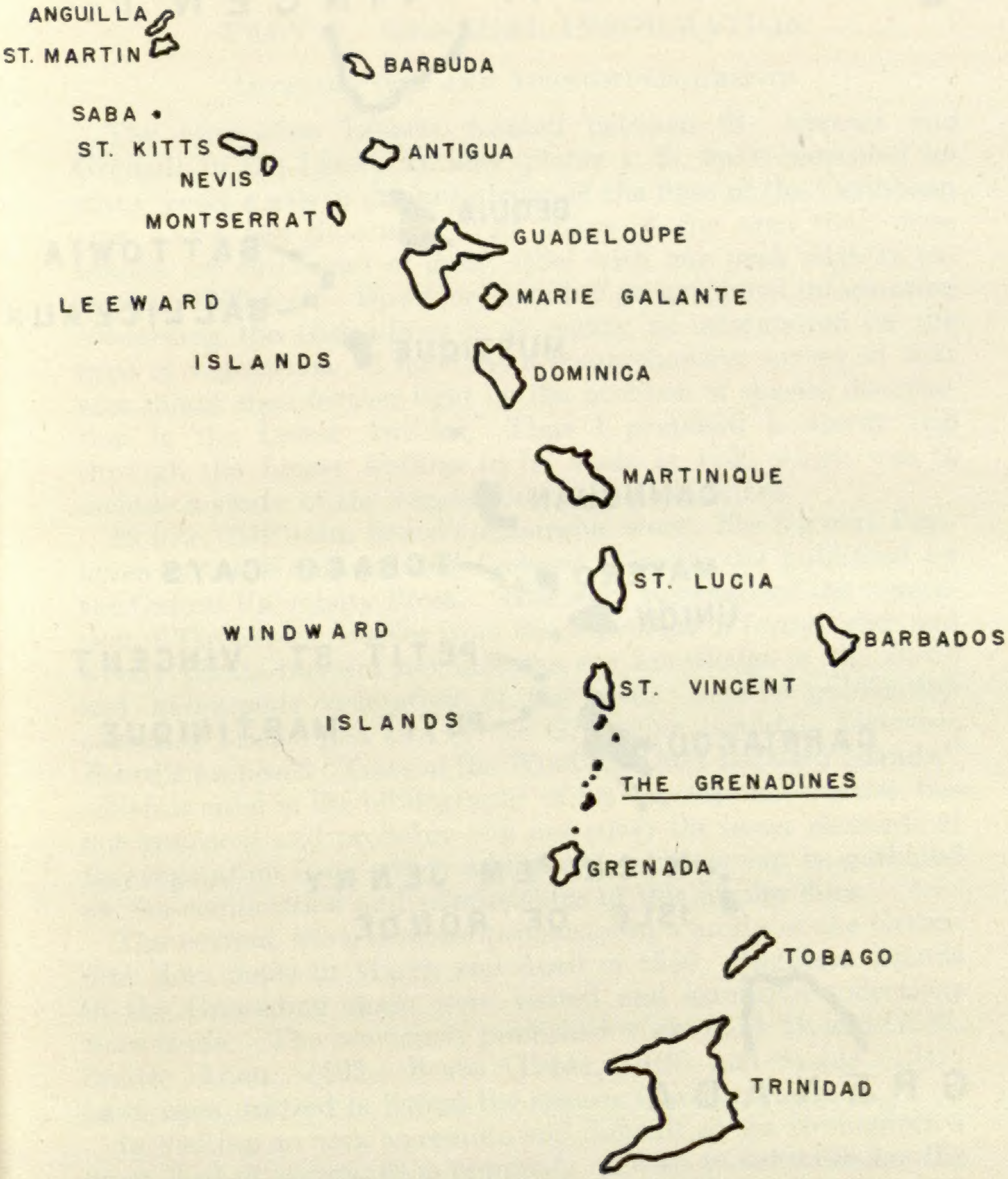

Plate 1. The Lesser Antilles.

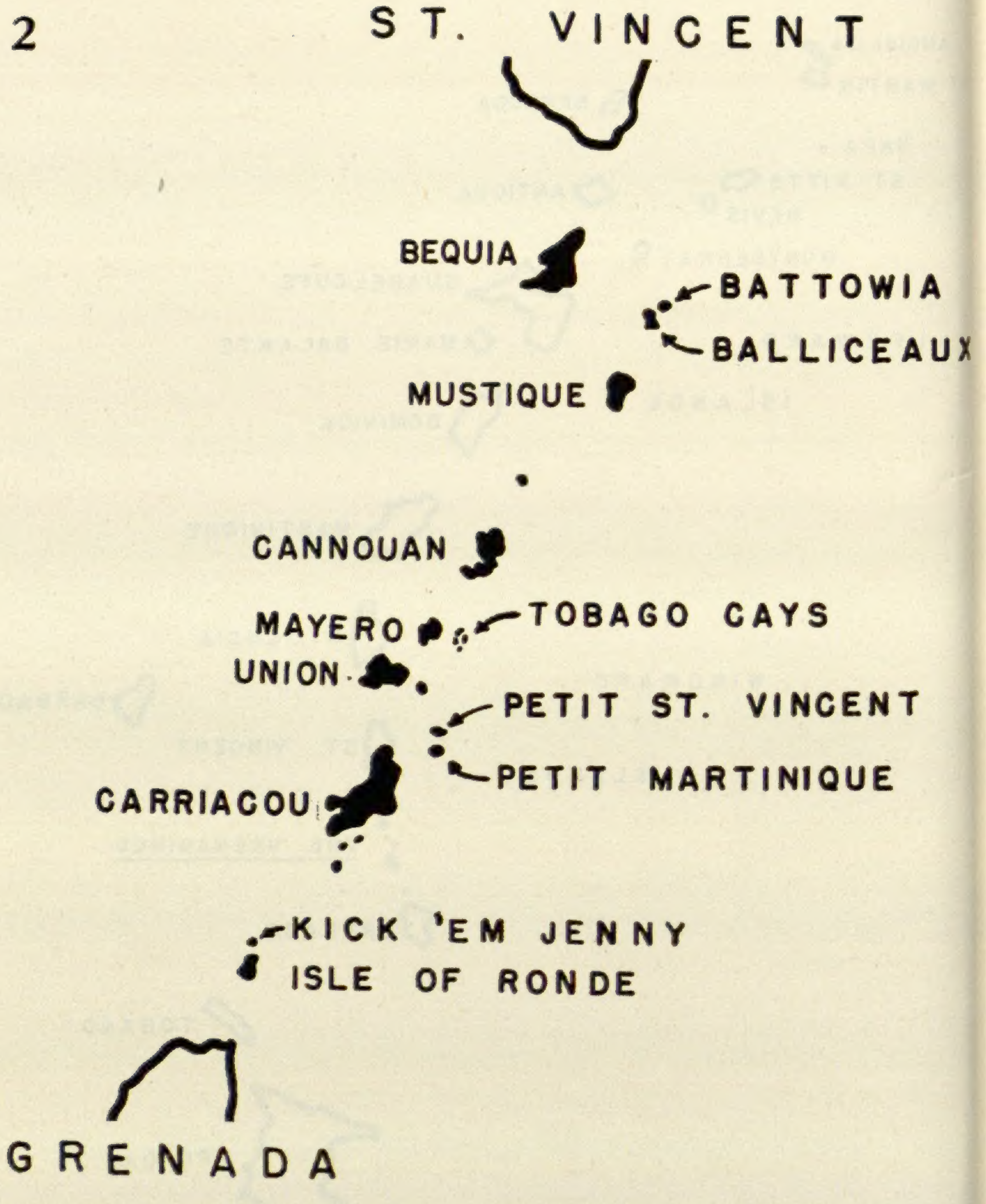

Plate 2. The Grenadines.

PART I. GENERAL INFORMATION

Introduction and Acknowledgements

The Grenadine Islands, located between St. Vincent and Grenada in the Lesser Antilles (plates 1, 2), have remained for many years a gap in the knowledge of the flora of the Caribbean area. One can determine from maps of the area that these islands are small and of great relief with one peak slightly exceeding 1000 feet. However, detailed geographical information concerning the Grenadines is as scanty as information on the type of vegetation. I felt that a comprehensive survey of that area might shed further light on the problem of species distribution in the Lesser Antilles. Thus I proposed a survey trip through the Lesser Antilles to be made in 1950 which was to include a study of the vegetation of the Grenadines.

In late 1949 John Beard's admirable work, *The Natural Vegetation of the Windward and Leeward Islands*, was published by the Oxford University Press. This work summarized the vegetation of the Lesser Antilles from the viewpoint of forest types and woody plants but did not increase our knowledge of the shrub and herbaceous vegetation of the area. Beard's publication considers briefly just two of the Grenadine Islands. Likewise, Beard's proposed "Trees of the Windward and Leeward Islands," which is cited in the bibliography of his vegetational treatise, has not appeared and probably will not cover the lesser elements of the vegetation from which additional evidence can be gathered on the composition and relationships of this insular flora.

The current work is based primarily on a study of the Grenadine flora made in March and April of 1950. Eighteen islands in the Grenadine chain were visited and extensive collections were made. The previously published works of H. H. and G. W. Smith (Anon., 1893), Beard (1944c, 1949) and Stehlé (1947) have been utilized in listing the species found in this area.

In visiting an area as remote and difficult as the Grenadines a great deal of assistance is required. I wish to acknowledge the support of the American Philosophical Society and of Harvard University for the financial assistance necessary for such a trip. In addition the friendship, encouragement and assistance of many people within the area is much appreciated. Special acknowledgement is due to James Ross of the Department of Agriculture and Father Brian Proudman of Sauteurs, Grenada, for their assistance in the work on Isle of Ronde and adjacent

islands; Wilfred Redhead, the acting District Officer of Carriacou, for the work on Carriacou and adjacent islands; Fred R. Phillips, the District Officer of Union, for work accomplished on the southern St. Vincent Grenadines, and to Hugh McConnie of the Department of Agriculture in St. Vincent and Allan Gunn of Kingstown, St. Vincent, for their assistance in my work on Bequia and adjacent islands.

The herbaria of the Arnold Arboretum, The Gray Herbarium, the New York Botanical Garden and the United States National Herbarium were visited to identify many of the plants collected and to study the few earlier collections from the Grenadines. I appreciate the privilege extended by the respective curators in the use of these collections.

Location of the Grenadines

The Grenadines are a chain of small islands located between Grenada and St. Vincent in the Lesser Antilles (plates 1, 2). The distance between the northern tip of Grenada and the southern tip of St. Vincent is 68.3 statute miles. The Grenadines occupy 59 miles of this distance as measured from the Isle of Ronde to the northern end of Bequia. These distances are based on the 1947 Aeronautical Chart of the Army Air Forces for the Windward Islands, number 705, and while differing from the distances previously published concerning these areas are probably more accurate.

The islands in the Grenadines have been variously estimated to be as numerous as 125. Actually there are ten islands with year-round inhabitants: Isle of Ronde, Isle of Caille, Carriacou, Petit Martinique, Union, Mayero, Cannouan, Mustique, Baliceaux and Bequia. Another six islands have temporary residents either during the fishing or growing seasons or as summer or vacation residents. In addition there are approximately one hundred uninhabited islands, islets, exposed and named rocks and reefs.

The islands comprise two political groups. The islands around and south of Carriacou are called Grenada territory and those from Union north to Bequia are St. Vincent territory. For purposes of administration the Isle of Ronde and the Isle of Caille are directly under the Grenada government with contact through Sauteurs, Grenada. The inhabited islands of Carriacou and Petit Martinique are under the jurisdiction of a local district officer at Hillsborough on Carriacou.

Union, Mayero, and Cannouan in St. Vincent territory are under the jurisdiction of a district officer with headquarters on Union Island. Union Island is the official port of entry for St. Vincent from the south.

Bequia and the islands of Mustique and Balliceaux are administered directly from Kingstown, St. Vincent, with a local representative of the government and a police force on Bequia.

In area the islands of the Grenadines represent about 50 square miles of land surface. The largest island is Carriacou with approximately 13 square miles. Bequia, Cannouan, Union and Mustique are all slightly more than 5 square miles in land area. The other islands are less than 5 square miles in area and range down to wave-washed rocks and reefs.

Geology of the Grenadines

The Grenadine Islands represent today the exposed summits of peaks on a single narrow bank of submerged volcanic mountains. If the current sea level were lowered 125 feet all of the Grenadines between Bequia and Carriacou would be united. This bank is 10 to 17 miles wide at its base and is separated from the Island of Grenada by a channel 600 feet deep and from the island of St. Vincent by a channel 3700 feet deep. To the east of the Grenadine block is the Tobago depth, reaching 6000 feet, and the Grenada depth to the west has been reported as 10,000 feet deep (Davis, 1926, Schuchert, 1935).

The Grenadine ridge came into existence in the late Oligocene period, sank or eroded away during the Pliocene, and was completely submerged during the Pleistocene period.

The current exposures in the Grenadines are described by Earle (1923, 1924) as largely made up of massive igneous rocks in situ, the older foundation rocks of the West Indies. Volcanic ashes, agglomerate tuffs, and boulder formations are not so conspicuous as in the larger islands of the Lesser Antilles. The Grenadines, according to Earle (1923, 1924), "owe their present isolated position largely to the fact that the earliest volcanic outbursts responsible for their formation were not followed to any great extent by later eruptions of the pyroclastic type. The Grenadines are typical of the earliest aspects of many of the larger islands before later pyroclastic rocks were piled on their partially submerged roots and carved by intense tropical denuding agencies into their present rugged conformations."

However, all of the larger islands of the Grenadines can be considered hilly because of their small size. The highest point

in the Grenadines is Pinnacle Peak on Union Island, which is approximately 1010 feet above sea level (plates 6, 8). Other islands may have ridges averaging 400 to 800 feet without predominating peaks.

The shore lines are irregular and usually deeply embayed. Coasts are predominantly wave-cut cliffs with limited areas of shell sand, coral sand (plate 8) or black volcanic sand beaches (plate 9). Deep water harbors are few and most of the embayments have shelves or coral rock blocking the entrance or limiting approach to the shore. The eastern or windward sides of the islands are usually fringed with exposed coral reefs usually composed of dendritic corals.

Erosion of the steep hillsides has proceeded rapidly on these narrow islands. Poor agricultural practices and a continuous heavy demand on the forest resources have left the soils exposed to heavy winds and a moderate amount of rain, with the result the top soil has been completely removed over wide areas, exposing large boulders of agglomerated tuff (plates 11, 13, 14, 16) and pavements of shoal rock.

Earle (1923, 1924) briefly described the geology of the various islands he visited and this information is summarized as follows. Bequia is characterized by pyroclastic rocks preponderant over massive. Balliceaux and Battowia are chiefly notable for the deposits of kaolin and recent guano. The wave-cut cliffs on these islands as seen from the north present a vivid rainbow of color embracing all hues from yellow to red to white, due to lateritization and kaolinization of the andesites in situ. These Earle describes as extremely heterogeneous and of little economic value. Mustique is composed largely of massive andesite in situ with comparatively little tuff or conglomerate. The southern end of Mustique has considerable reef quartz scattered about and associated with the quartz is a certain amount of jasper. Pitch adheres to some of the beach boulders. The northwest promontory of Mustique on which the village stands is massive jointed lava, and similar areas to the eastward are traversed by veins of ironstone. Union, the island with the most spectacular relief, consists of weathered rugged volcanic rocks and agglomerates. A few volcanic bombs have been exposed by recent erosion. The commonest rock on Cannouan gives the appearance of compacted ash. Epidote has been reported as crystals and as incrustation on some of the rocks. Pseudo-bedded ashes are common in beach exposures and the only limestone reported has been found on Cannouan. Mayero is of interest as the site of the only

petrified wood reported from the Grenadines. I made a search for these fossils but could not locate any in my brief stop on Mayero.

Climate

The climate of the Grenadines, in contrast to the Lesser Antilles as a whole, is a relatively uniform one. A fairly constant strong northeast breeze prevails throughout the year. The temperature, from the scanty records available, averages nearly 76 degrees F. with little seasonal or diurnal change. The majority of the days are sunny; few days are completely overcast. Because of the low character and small size of the islands no rain clouds hang over these islands even during the rainy season, as one sees so characteristically on the larger islands. Hurricanes have hit the islands in the past but, since communication is difficult and most of the housing temporary, little notice has been taken of these occurrences and no records kept of such storms. An old resident of Cannouan Island reported one hurricane during his lifetime but he was indefinite as to the date of its occurrence.

The most significant aspect of climate in the Grenadines is the rainfall, or lack of it. As early as 1831 Charles Shephard in describing the Grenadines reported, "Since the abandonment of the cultivation of cotton, the interest and importance of these islands has proportionately decreased. Their general characteristic is a great fertility of soil, even with the small quantity of rain that at present falls among them, a failure which is to be attributed to the destruction of the woods, especially the white cedar, which was abundantly cherished as a protection to the cotton plantation; the pureness and salubrity of the air is very remarkable, the health and longevity of the inhabitants is proportionate and horned cattle and sheep, which are reared there, are of excellent quality; but in dry seasons great inconveniences are experienced from the want of water, there are no rivers, the few ponds are soon dried up and the tanks or reservoirs of rain water, which are a necessary appendage to every establishment are occasionally exhausted and great mortality among the stock is the consequence."

Rain storms form out to sea generally to the east or southeast of the Grenadines and seem to move without being affected by the small land masses of the Grenadine Islands. It appears to be only chance when a storm hits any one of the Grenadines.

Rainfall records for the Grenadines are scanty due to the lack of interested recorders. The few records available, given below,

were those in the files of the Departments of Agriculture in Grenada and St. Vincent.

Bequia had a high of 113.13 inches of rainfall; a low of 55.62 inches and an 11 year average of 74.01 inches annual rainfall. Cannouan had a high of 70.03; a low of 38.06 and an 11 year average of 43.39 inches of rain. Mayero had a high of 54.67 inches; a low of 26.71 inches and an 11 year average of 35.64 inches of rain. Union had a high of 62.24 inches; a low of 25.79 inches and a 13 year average of 37.67 inches of rain. Carriacou had a high of 79.19 inches; a low of 33.25 inches and a 15 year average of 51.62 inches of rain.

Monthly rainfall distribution data is available from the records of Union Island over a seven year period, 1943–1949, as shown in the following table.

	High	*Low*	*Average*
January	2.17	0.49	1.29 inches
February	1.66	0.26	0.89 "
March	2.16	0.40	0.95 "
April	3.17	0.41	1.42 "
May	3.43	0.09	2.39 "
June	6.59	1.59	3.25 "
July	7.80	1.79	4.27 "
August	9.30	2.89	5.42 "
September	6.84	2.37	3.90 "
October	10.00	4.22	5.51 "
November	8.67	1.63	4.52 "
December	5.57	1.81	3.29 "
Average	5.61	1.49	3.09 "

Bequia is only 9 miles from St. Vincent and Carriacou is about 15 miles from the northern end of Grenada. Both of these islands seem to receive some extra rainfall, being in the rain shadow of larger islands. Union and Mayero, central islands in the Grenadine chain, show a much lower annual rainfall. The effects of this low annual rainfall are evident on the vegetation and the agriculture of the area. A lack of soil-covering vegetation permits rapid runoff of what little rainfall the islands receive. Water supply is a definite problem on all of the islands. In recent years the local governments have built rock catchment areas and storage tanks to supplement the dirt ponds previously used. Tanks and cisterns collecting rain water from the roofs of private houses are also used. However, the total rainfall collected does not equal the demand and it is still necessary to

import water for human consumption throughout the year on such islands as Balliceaux and during the dry season on practically all of the islands.

It is interesting to note that even today there is a feeling among the inhabitants of these islands that the lack of available water is due to the destruction of the forest cover. Forward looking citizens would like to increase the soil cover and alter such agricultural practices as vertical planting and the practice of pulling and burning the cotton but the practical aspects of population pressure and economy rule out any extensive reforestation project in the immediate future.

Agriculture in the Grenadines

In spite of the small land area involved in the Grenadines, the early references to these islands invariably mention the fertile soil and productive agriculture. Slave labor was first introduced in the Grenadines in 1675 on Bequia and the present population, 70% Negroid, reflects the effects of this slave labor on the history of the islands. In 1831 the slave population was estimated at 6000, the slaves being utilized primarily in the production of sugar cane. Slavery was tentatively abolished in the British islands of the Lesser Antilles in 1836 followed by unconditional emancipation in 1838. Shortly after that there came a "crisis" in sugar. History reports the crisis was due to a drop in the world market for sugar correlated with the expansion of sugar beet production in Europe but in the Grenadines there appear to be three causes of the local sugar crisis. With the abolition of slavery a metayer system of agriculture developed, and the slaves turned to this form of tenant farming of small crops rather than labor on the sugar estates. Thus the loss of a cheap supply of labor was coupled with a decline in the world market for cane sugar. Freed labor was more costly than slave labor and the cost of production of cane sugar increased. About the same time the local supply of fuel diminished to the point where wood for the evaporation of the cane syrup was being imported from South America, principally British Guiana. This expensive fuel further added to the cost of sugar and sugar was abandoned as an agricultural crop of the area. The production of sugar in 1831 is reported as 25,000 tons. In 1848 that had dropped to 12,000 tons and by 1859 to 8,000 tons. Today little sugar is grown except for local consumption.

The population figures for the Grenadines in relation to this period of sugar crisis are also interesting. A slave population in

the Grenadines was reported as 6000 in 1831 and the total population at 9500, but by 1844 the total population of the Grenadines was 5713. During this period, 1831–1844, the old records of St. Vincent and Grenada, adjacent islands to the Grenadines, show an increase in the supply of free labor and of population. By 1854 the population of the Grenadines had climbed to 6394 although it is not clear whether this is due to an increase in the local population or a re-immigration of the former inhabitants of the area. The population of the Grenadines continued to fall during the last part of the 19th century until in 1910 the population was reported as 2500 persons. By 1931 an increase was noticed in the population figures of 3683 and the 1946 census reports 4472 people now living in the area.

Cotton, which had been grown in small amounts for local consumption during the period of high sugar production, came into its own with the abolition of slavery and the sugar crisis. It seems many of the freed slaves turned to cotton as a crop to be grown on small land holdings or under the metayer system. Cotton has remained a principal agricultural product of the area to the present time. The Marie Galante strain of cotton was grown until 1930 and since then it has been gradually replaced by the improved Sea Island cotton, especially the V135 strain developed on St. Vincent. Marie Galante is a short staple cotton which grows as a perennial requiring little cultivation and has always brought a low price on the cotton market. The current crop of Sea Island cotton (plate 28), however, is a long staple cotton which brings a much higher price. Sea Island cotton is grown as an annual and being a smaller plant requires more field cultivation to keep down the weedy growth of other plants. Cotton crops in the Grenadines in recent years have been marketed through government agencies or cooperatives. With the switch to Sea Island cotton a careful check is necessary to keep the product pure. This has meant a systematic extermination of all the crops of Marie Galante and particularly the wild or escaped plants of this strain. Current legislation prohibits the growing of Marie Galante cotton or the presence of plants of this strain on the islands.

The occurrence of escaped or residual plants of Marie Galante has become of increased importance in recent years because of insect infestations of the cotton boll. A cotton staining insect particularly has been costly to the production of cotton, for the stained cotton fibers must be removed by hand labor to keep the cotton at the standard set by the government. At the present

time agricultural insecticides which might be used to control the insects affecting the cotton crops are produced in the United States. Because of monetary controls on the Dollar and the Pound and local governmental controls on expenditures, the cotton farmer is unable to purchase the necessary chemicals. The necessity of controlling the insect pests without insecticides has led to the adoption of a dangerous agriculture practice. Cotton plants must be pulled and burned at a certain period each spring decreed by the government, and a new crop cannot be planted before another date established by the government. By removing the plants it is hoped to remove the cotton staining insect menace by starving the insects. All wild cotton, therefore, must be removed and even relatives of the cotton, plants on which the insects might feed as alternate food plants, have been killed or removed. Thus by the removal of the cotton plants the already impoverished land of the Grenadines is exposed without ground cover to the forces of erosion during a period of several months. Increased erosion is noticeable in many areas due to this practice.

Shephard (1831) reports that cotton cultivation was abandoned prior to 1831 when sugar production was high but by 1854 Union and Cannouan were growing cotton exclusively and Bequia and Mustique were growing cotton and indigo. Plants of *Indigofera suffruticosa* persist as weeds of cotton fields on many of the Grenadine Islands today, but the plant is no longer harvested.

Limes, nutmegs and cacao were grown in Carriacou in the late years of the 19th century but neither nutmegs nor cacao were successful. Limes did do well, especially on the southern portion of Carriacou until 1920; but at the present time these groves have been almost abandoned. What fruits are produced are still gathered and the juice and oil extracted in two small mills on Carriacou but no further plantings are being made.

The coconuts planted in the Grenadines in the late 1870's were wiped out by the coconut blight a few years later. A small plantation of coconuts is found on Bequia today, but on all the other islands the trees are few and of no commercial significance. Pieces of mature coconut meat serve as a source of cooking oil in local culinary practices and coconuts are imported today into all of the islands of the Grenadines.

An attempt was made to grow arrowroot on Bequia around 1910 following the success and the importance of this crop on St. Vincent, but this too proved to be a failure.

With the abandonment of sugar cane as a crop on Mustique, the land was allowed to return to pasture and stock was imported. Mustique is still primarily a stock-producing island and the raising of stock is much more significant through the Grenadines today than any of the agricultural crops. The low rainfall limits the future of either stock or agriculture in the Grenadines. Due to the exhausted soil, poor pasture land, and the extent of erosion, it appears that any future the Grenadines might have will be closely related to a scheme not yet proposed to introduce good pasture grasses to cover the soil and reduce erosion and then to raise stock.

The 1946 economic survey of the island of St. Vincent and its Grenadine territory (anon. 1946) reported that 1212 acres of land were under cultivation. This is out of a possible total of 50,000 acres in the St. Vincent Grenadines. Of the 1212 acres 228 plots were less than an acre but more than 1/20th of an acre. It is clear that this is a very small fraction of the land cultivated in the early 19th century when sugar was at its peak.

The same report listing the occupations in the Grenadines lists 700 people as agricultural workers, peasant proprietors or share tenants. 200 were listed as seamen, 350 as fishermen, 100 as road laborers, 100 as shipwrights, carpenters or masons, 50 as seamstresses and 50 as domestics.

70% of the current population of the Grenadines are Negroes. The rest are listed as white peasants of English or Scotch descent, East Indians, Portuguese or Carib Indians.

It is clear that agriculture has steadily diminished as an occupation in the Grenadines and that the amount of land under cultivation is a small fraction of the former cleared land. Many of these abandoned lands have now grown back in a shrub woodland (plates 14, 15). Other formerly cultivated lands still show a weedy vegetation (plate 24) since milpa or migratory agriculture is still carried on within the agriculture practiced today.

Vegetation of the Grenadines

In 1944 John Beard (1944a) proposed a system of classification of vegetation types in tropical America. This system was considered and adopted by the pan-Caribbean Forestry Meeting in 1946 and is in general use in Forestry Departments throughout the Caribbean Islands at the present time. In Beard's book (1949), *The Natural Vegetation of the Windward and Leeward Islands*, this system of classification of vegetation types was expanded in relation to the flora of the Lesser Antilles. For this

area, which includes the islands from Trinidad and Tobago north to the Virgin Islands, the system works very well. In the Greater Antilles, however, the proposed classification breaks down. It appears to me that if the islands of Trinidad and Tobago and the Greater Antilles are excluded as distinct floristic areas, Beard's classification and nomenclature as applied to the Lesser Antilles is remarkably workable.

Beard's suggestion of the term "seasonal formations" for the vegetation found in the Grenadines is a good one. A seasonal drought, that is, a period when evaporation exceeds the available moisture, is the predominant character of a seasonal formation. C. F. Charter (1941) has suggested that the critical point in the relationship of precipitation to evaporation from the standpoint of the vegetation is at a monthly fall of four inches of rain. Beard agrees with this figure for the West Indies. A monthly rainfall of less than four inches indicates an evaporation rate greater than the precipitation of moisture, hence a condition of dryness. This seasonal drought or rainfall deficiency may be of short duration and have little effect on the type of vegetation, or may be longer than the wet period and so determine the type of vegetation cover on the land. Longer and longer drought periods bring increasing poverty of the flora. The period of drought may also influence the stature of the vegetation and influence the life-form of the plants.

In the monthly rainfall figures given for Union Island under the section on climate, it is clear that the average monthly rainfall is less than the required four inches in eight out of twelve months. If the lowest figures for each month could be taken as representing the extreme of dryness then evaporation would exceed precipitation in 11 months of the year, while if the highest figures recorded for each month represented the maximum of rainfall then only five months would represent conditions of drought.

It is evident in the Grenadines that evaporation exceeds precipitation on all of the islands to the point where the vegetation is influenced, and even the seasonal formation is not of the most luxuriant type.

It is Beard's observation that seasonal forests occur generally in lowlands and that the ground must not become inundated except for short periods of the year. Certainly the rugged terrain of the Grenadines meets these conditions. Seasonal forests usually lack a grass cover and this is also true in the Grenadines.

Beard suggests three divisions of the seasonal formations, an evergreen seasonal forest where the trees do not lose their foliage, a semi-evergreen seasonal forest with the majority of the trees evergreen, and a deciduous seasonal forest with the majority of the trees deciduous.

The woody vegetation of the Grenadines would be classified as predominantly of the deciduous forest type, although a few examples of semi-deciduous seasonal forests can be found on Carriacou, Cannouan and Bequia. A small section of the north ridge of Bequia might be classified as an evergreen seasonal forest.

The forest areas of the Grenadines consist of trees 20 to 40 feet tall with crooked short boles and low branching. The canopy is open and some shrub growth is found in places. Many areas are overgrown with vines, epiphytes are abundant, and on rocky exposures the forest floor is overgrown with bromeliads. There is little hope that this area could ever produce an economically profitable forest.

The forested areas of the Grenadines are secondary formations. At one time practically every possible acre of land has been under cultivation and those not cultivated have been extensively cut back by the pressure of population needs.

Beard suggests nine sub-climax communities within the deciduous seasonal forest type found in the Lesser Antilles (1949, p. 79–80). Most of these are the result of human interference and the abandoment of previously cultivated land. Lands once cultivated and abandoned in the Grenadines seem to grow up in one pure stand of vegetation. The species dominating this stand depends on the seed plants near by but also on the location, relief of the area and the substratum. Thus *Croton* thickets (plate 24) *Cordia* thickets, *Leucaena* thickets, and Logwood-Acacia thickets (plate 27) appear most frequently. To the thicket sub-climaxes proposed by Beard I would for the Grenadines add *Bauhinia ungula* as a thicket type and also *Cnidoscolus urens* (plate 14), for both of these plants will dominate recently abandoned lands. Several of these stands are known to be at least 25 years old and still show little sign of invasion by the deciduous seasonal forest components. Most of these seasonal forest type sub-climaxes are found on the leeward slopes of the Grenadine Islands.

On the windward slopes of these islands and on all of some of the smaller islands a Littoral woodland of the Dry Evergreen formation proposed by Beard will predominate (plates 19, 25). Since most of the Grenadine Islands have wave-cut cliffs, the

and one specimen of *Caesalpina Bonduc*, although this might have been of local origin.

Dr. Nichols in his diary reports finding the fruits of *Saccoglottis amazonica* on the beaches in Mustique in 1891. I also found specimens of a fruit referable to this genus on beaches at Union Island and again on the shore of the bay south of Mt. Royal on Cannouan Island (plate 20). All of the fruits picked up, however, were old, well washed and showed no signs of embryos.

Sargassum alone formed the drift belt at the summits of beaches (plate 9) and no other vegetative portions of plants were found in the Grenadines as were so abundant in the Bahamas. It seems that drift plays little part in the establishment of beach vegetation anywhere in the Grenadines.

Medicinal Plants

Medical attention for the people of the Grenadine Islands is supplied by the governments of Grenada and St. Vincent for their respective territories. A doctor is stationed on the island of Bequia where a small clinic and dispensary has been established. The doctor makes periodic visits to the other islands of the St. Vincent Grenadines and can be called by radio-telephone for emergencies. Union Island, the southernmost of the St. Vincent Grenadines, also has a small dispensary which is operated by a pharmacist and a nurse. Two beds are maintained for cases of illness. A dispensary with a pharmacist and a nurse is also present on the island of Carriacou in the Grenada Grenadines and a doctor from Sauteurs, Grenada, makes periodic visits to that island.

The pharmacists supply medical assistance without charge except for the cost of special medicines. A visit to the doctor costs the patient one shilling plus the price of special medicinals. However, even this low price is more than some of the residents of the Grenadine Islands can or will pay for medical services. As a result, local medicinal plants are still widely used in the treatment of many ailments.

Many medicinal plants were obtained directly from the residents of the Grenadines during my field work there or purchased from "herbalists" or at small stores. However, those listed below represent not only my own information but also information obtained by Dr. W. S. Kulesza, who was resident physician on Bequia in 1950. Dr. Kulesza, a European trained physician, was sincerely interested in the welfare and health of his patients and at my request obtained from residents of Bequia compre-

hensive data not only on what plants were used in native medicine but also how and with what effectiveness. I am particularly grateful to Dr. Kulesza for sending many medicinal plants of Bequia for determination. Probably the majority of medicinal uses mentioned in the following paragraphs represent the efforts of Dr. Kulesza.

The majority of the plants used medicinally by the residents of Bequia and other islands of the Grenadines are taken in the form of teas. In most cases the leaves are steeped in water to make a hot tea. A few of these brews are sweetened with sugar. For children, the dosage of tea is generally one teaspoonful to a glass of milk.

The plants mentioned in the following list which are preceded with an asterisk are very popular drugs in which the action is "definitely positive" and are considered the most reliable.

Reduce fevers: **Clerodendrum aculeatum*, **Enicostema verticillatum*, *Phyllanthus niruri, Annona muricata.*
Malaria fevers: **Phyllanthus Niruri.*
Coughs and colds in adults: **Eupatorium odoratum, Merremia dissecta, Lantana reticulata, Abrus precatorius, Annona muricata, Ocimum basilicum.*
Colds in infants: *Achyranthes indica, Ocimum micranthum, Merremia dissecta.*
Bronchitis in children: *Eupatorium odoratum* in milk.
Sore throat, quinsy or tonsilitis: *Solanum igneum.*
Marasmus: *Sida cordifolia, Priva lappulacea, Citrus aurantifolia.*
Anemia: *Waltheria americana, Psychotria nervosa.*
Improve appetite and indigestion: *Mormordica charantia* (men only—see abortion).
"Health" tea for children: *Peperomia pellucida, Alternanthera ramosissima, Priva lappulacea, Citrus aurantifolia, Achyranthes indica.*
Diarrhoea of adults: **Euphorbia hirta, Euphorbia prostrata, Psidium guajava, Pimenta racemosa.*
Diarrhoea of children: *Pilea microphylla.*
Stomach ache: *Leonotis nepetaefolia.*
Eczema: *Leonotis nepetaefolia*, used as a poultice or salve.
Sedative: *Annona muricata.*
Vomiting: *Annona muricata.*
Diabetes: **Lochnera rosea.*
Worms: **Chenopodium ambrosioides.*
Headache: *Acalypha Wilkesiana.*
Amenorrhea: *Annona squamosa, Lantana camara, Sida cordifolia.*
Dysmenorrhea: **Ocimum micranthum*, **Passiflora suberosa.*
Reduce pain during labor of childbirth: *Clerodendrum aculeatum.*

Abortion producing: **Mormordica Charantia.* This plant is widely used for this purpose throughout the Antilles. The properties of a tea made from the leaves are known to people of every island. It appears to be used monthly by women in many of the Lesser Antilles as an effective method of birth control through early abortion. Note that the same tea is taken by men to improve appetite and control indigestion.

Tea for morning sickness during pregnancy: *Lantana camara.*

Clear up lactation following pregnancy: *Stachytarpheta jamaicenis.*

Burning after urination, nephritis in general: **Ruellia tuberosa.* The roots of this plant are pounded and steeped to form a tea. In general this plant is widely used in the Antilles to relieve the pains accompanying venereal diseases.

Inability to urinate: **Tragia volubilis.*

"Something moving inside the body": a poultice of *Citrus aurantifolia* leaves applied externally. Again a widely used treatment throughout the Antilles.

Antidote for internal manchineel poisoning: Solution of Arrowroot starch.

Antidote for external manchineel poisoning: Poultice of Arrowroot starch.

Laxative: *Croton flavens, *Jatropha curcas.*

History of Botanical Collecting in the Grenadines

The earliest collections known to me from the Grenadines are those of H. H. and G. W. Smith and reported in Kew Bulletin **81:** 231–296. 1893. None of the earlier collectors of the Antillean region appear to have visited these small islands.

The Kew Bulletin report, entitled Flora of St. Vincent and Adjacent Islets, was published anonymously and so is difficult to cite. In the introduction to this list of collections it is stated that in 1889 Mr. F. Ducane Godman hired Mr. H. H. Smith, an American, who with his wife went to St. Vincent to collect plants. H. H. Smith was previously a zoological collector. While at St. Vincent they engaged as assistant in botanical collecting, Mr. G. W. Smith, who in 1893 was listed as curator of the Botanical Garden in Grenada. G. W. Smith was a native of the Windward Islands. The role of Mrs. H. H. Smith in the program of botanical collecting has not been stated and none of the specimens bear her name; however, the Smiths apparently had with them a Joseph Dalton, for many of the labels bear his name as collector with or for either H. H. Smith or G. W. Smith. Apparently these men traveled either independently or in various combinations throughout the Grenadines for their collection numbers show no systematic method of travel. Many of the Smiths' numbers have been duplicated, several collection numbers having been used four times for four different plants, often

from different and widely separated islands. Urban handled this confusing problem in the simplest manner by citing "Smith" as collectors. Some recent monographers have given Dalton credit for certain collections made exclusively by him.

Dalton's name on many of the labels is handwritten as Dalton, Joseph or Dalton Joseph without the comma, as well as Joseph Dalton which seems to be correct. This variety of arrangement has also led to confusion in citation of Dalton's collections. I have not been able to find any reference to Dalton in other literature on the area and conclude he was a helper on this party and was probably a native West Indian.

When the Smiths' collections were distributed by the Kew Garden Herbarium a mimeographed list of the collections was also distributed. A copy of this list is in the library at the New York Botanical Garden and one sentence on the list reports that "on some of the original tickets the island of Mustique is represented by the letter G, the island of Union by D." From this one might assume that the Mustique specimens preceded by the letter G were collected by G. W. Smith and those of Union preceded by the letter D by Joseph Dalton. However, others of the handwritten labels bear the initials U, M or C plus a number. It cannot be safely assumed that U, M, and C represent Union, Mustique and Cannouan Islands as many of the "U" collections bear the locality Bequia.

These letters have been the source of much confusion in citing these collections. The letter "G" in many cases has been interpreted as a "6" and the number erroneously cited.

Throughout this paper the collections by H. H. and G. W. Smith and Joseph Dalton will be cited as "Smiths" plus a number. The letter prefix will not be used.

A few of the Smiths' collections were never completely identified and are cited in the mimeographed list as well as the Kew Bulletin publication with a question mark or only as "sp." Apparently these unidentified specimens were never distributed for I have not seen them in the American herbaria examined. A few of these incomplete determinations, however, have been cited by Urban or his co-workers in their treatments of such families as the *Apocynaceae*, *Myrtaceae* and *Solanaceae* in issues of the Symbolae Antillanae.

H. H. Smith, G. W. Smith and Joseph Dalton collected 375 species on Bequia, 160 species on Mustique, 49 species on Union and 30 species on the island of Cannouan.

Apparently while these men were collecting they also had the help of H. Powell who, in 1890, was curator of the Botanical Garden in St. Vincent. Some of Powell's collections are cited in the list of Grenadine material in the 1893 Kew Bulletin. Apparently Powell continued to collect specimens which were sent to Kew after the Smiths left the area.

Urban in his list of collectors in the Caribbean area refers to a series of specimens collected by H. Baron von Eggers from the island of Bequia. Eggers collected on Tobago, Grenada, Bequia, St. Vincent and Barbados between Oct. 20, 1889 and Jan. 31, 1890. Eggers' numbers from Bequia are 7028 to 7073 and were collected in January 1890. A few of these collections are in the Gray Herbarium and are cited in the list given in this paper. I cannot find a complete list of the Eggers numbers and some of the missing numbers may well represent additions to the current list.

Dr. H. A. Nichols of Roseau, Dominica, visited the Grenadines in May and June of 1891 while on an official trip surveying the incidence of yaws in the Windward Islands. Dr. Nichols was an accomplished naturalist and his personal diary of that trip has been presented to the library of the Gray Herbarium by his daughter, Miss Maggie Nichols, also of Roseau, Dominica. Dr. Nichols' diary and his comments on the vegetation of the Grenadines has been used extensively in this paper to compare the flora of 1891 with that seen in 1950. I am deeply indebted to Miss Nichols for the privilege of referring to and quoting from her father's diary. During the course of this trip Dr. Nichols collected a few specimens which he reports sending to Kew for determination. I have not seen the Nichols specimens but refer to his field determination of them in this paper.

The Allison V. Armour expedition of 1932 apparently stopped on Cannouan on February 8, 1932. I have seen one specimen collected by David Fairchild (*Ficus laevigata, Fairchild 2794*) collected by this party but no records of the stops or collections of this expedition are available for possible additional records of the Grenadine flora.

In 1933 the III Caribbean Expedition of G. Proctor Cooper, III stopped at Union Island on February 26 and on March 26. I have seen three collections made by Cooper.

John Beard and his wife, Pamela Beard, have made the most extensive recent collections in the Grenadines. John Beard's itinerary is reported in outline form in his book *The Natural Vegetation of the Windward and Leeward Islands* (1949, p. 7–8).

Beard made a preliminary reconnaissance in Grenada and St. Vincent in October 1942 and "detailed stocktaking in all the Windward Islands" between May 1945 and April 1946. Both John Beard and Pamela Beard made general collections which were distributed separately. John Beard's collections served as the basis for several additions to the Grenadine flora mentioned in his "Provisional List of Trees and Shrubs of the Lesser Antilles" (Carib. For. **5:** 48–66. 1944). A partial set of John Beard's collections is in the herbarium of the Arnold Arboretum. His specimens which I have seen and references to his collections are cited as J. Beard.

Pamela Beard's itinerary is presumably that of her husband. A complete set of her specimens is in the Gray Herbarium. Pamela Beard's collections are cited in this paper as P. Beard.

Following the appearance of Beard's paper presenting a provisional list of the trees and shrubs of the Lesser Antilles, Henri and Mme. Stehlé published a "Liste Complementaire des arbres et arbustes des Petites Antilles" (Carib. For. **8:** 91–111. 1947) giving a list of additions and corrections to Beard's list. The Stehlés state that their additions to Beard's list, including some from the Grenadines, are based on personal collections from nearly all of the Lesser Antilles, including English possessions, as well as a more careful search of the literature. I have seen a very few of the Stehlés' collections in the United States National Herbarium and in the herbarium of the Arnold Arboretum. Unfortunately these few specimens give no clue to the Stehlés' itinerary.

My own collections cited in this paper are in the Gray Herbarium. Duplicate specimens are to be distributed at a later date. The distributions given for individual species are based on actual collections as well as a check list kept in the field to avoid repetitious collections of the more common species. My itinerary and collection numbers were as follows: Isle of Ronde, March 7–8, 1950, 10710–10780; Kick 'em Jenny, March 9, 1950, 10781–10794; Carriacou, March 14–19, 1950, 10796–10893, 10936–10964; Petit St. Vincent, March 17, 1950, 10894–10916; Petit Martinique, March 17, 1950, 10917–10935; Large Island, March 18, 1950, 10965–10966; White Island, March 18, 1950, 10967–10974; Union Island, March 20–21, 25–26, 29–30, 1950, 10975–11018, 11120–11123; Prune Island, March 22, 1950, 11019–11021; Tobago Cays, March 23, 1950, 11022–11035; Mayero, March 24, 1950, 11036–11055; Cannouan, March 27–29, 1950, 11056–11119; Mustique, April 9, 1950, 11222–11228;

Bequia, April 10–12, 1950, 11229–11285; Balliceaux and Battowia, April 12, 1950, 11286–11291.

PART II. THE VEGETATION OF INDIVIDUAL ISLANDS

Isle of Ronde

The Isle of Ronde (plates 7, 19, 25) is located about fourteen miles north of Grenada off the port of Sauteurs. The island is about one mile long on an axis running SE-NW and averages between one-half and three-quarters of a mile in width.

Fifty years ago the Isle of Ronde was considered to be an excellent island with fertile soil and a good and permanent supply of water. Dr. Nichols reports that in 1891 there was consideration of making the island a self-supporting leper colony for Grenada. At the present time most of the island has grown up in a thorn shrub with only the southeast corner under cultivation. About fifty people live on the island and the water supply is uncertain. Within the last five years a water reservoir has been built with the roof of this masonry structure being the catchment area. Even with this reservoir, it is necessary to bring water in from Grenada during the dry period.

The Isle of Ronde consists of two rows of low hills approaching 300 feet in height separated by a low plain, the center of which is close to sea level. The center of the plain has an evanescent lake of brackish water, the marginal vegetation of which is red and black mangrove.

A very good beach is found on the south coast of the island, and on the northeast corner is Half Moon Bay, reported to be the most beautiful bay in the Grenadines, with a spectacular curving coral sand beach (plate 7). Another small and protected landing spot exists on the leeward side near the northern tip of the island. The rest of the coastline consists of sea-cut cliffs.

Only a few acres of land on the southeast corner are now cultivated. The crop in March, 1950, was pigeon peas, which are planted in June, mature in February and produce three crops, one about every two weeks, before dying out. In other years squash and melons are grown for sale in Grenada. Numerous custard apple trees were found on the south end of the island but were not in fruit.

From the botanical point of view the feature of the Isle of Ronde is the windward slope, about the middle of the island,

which is grassy or tundra-like in appearance (plate 19). This area is wet with some seepage existing in a drainage pattern in the middle. The area is used as a grazing spot for tethered cattle. The low vegetation here consists of *Alternanthera polygonoides*, *Trianthema Portulacastrum*, *Heliotropium curassavicum*, *Evolvulus glaber*, *Dactyloctenium aegyptium* and *Pectis humifusa*. *Alternanthera ramosissima*, generally a climbing plant, is present in this park-like area in a prostrate succulent form.

This area is bounded on all sides by a windswept, contorted thorn shrub. To the north, however, the seacoast area is open rocks and boulders covered with *Cactus Broadwayi* (plate 25) and *Agave caribaeicola*. Immediately above the cliff face area and the park-like zone is an extensive development of *Opuntia Dillenii* which apparently has grown tall and rotted out at the base, collapsing in a spiny, almost impenetrable zone among boulders. *Pedilanthus tithymaloides*, *Bidens cynapiifolia*, *Corchorus aestuans*, *Malvastrum corchorifolium*, and *Justicia periplocifolia* grow among the plants of *Opuntia*, adding color to the gray-green of the cactus stems.

The shrub zone above the *Opuntia* area is dominated by *Coccoloba venosa* in its most branched form, forming plants to ten feet tall. Associated with the *Coccoloba* are *Bourreria succulenta*, *Diospyros inconstans*, *Citharexylum spinosum*, *Jacquinia barbasco*, *Randia aculeata*, *Malpighia punicifolia*, *Croton flavens*, *Cordia globosa* and *Capparis odoratissima*, cited in order of frequency. In the protected spots this shrub grows to twenty feet in height. The shrub zone is heavily populated with weak climbing herbaceous plants such as *Capsicum baccatum*, *Tragia volubilis*, *Solanum lancifolium*, *Trixis radialis*, *Corallocarpus emetocatharticus* and *Trichostigma octandrum*, which covered the shrub zone in many areas. *Tillandsia flexuosa* and *Tillandsia utriculata* occur as epiphytes in the shrub zone. *Cnidoscolus urens* abounds as a low plant under the shrub, making progress on foot difficult. *Cyperus compressus* and *Scleria lithosperma* are the only low plants in the shrub zone. The area appears to be undisturbed except for cutting for fuel by the local inhabitants of the island. The rocky substratum indicates that no agriculture existed in this area, and the aspect of the vegetation is that of undisturbed zones found elsewhere in the Grenadines, rather than the spiny shrub type that follows cultivation.

From a small promontory on the northeast corner of the Isle of Ronde one has a magnificent view of Half Moon Bay and the island of Kick 'em Jenny (plate 7). The vegetation behind the

coral sand beach of Half Moon Bay is dominated by *Coccoloba uvifera* and *Hippomane Manchinella.* Proceeding northwest past this beach one encounters a series of old salt flats now abandoned and grown up into dense wooded thickets of mangrove. The dominant plant in these old salt flats is *Avicennia nitida* with a dense growth of pneumatophores at the base. These trees are all 20 years old and about 30 feet tall and 10 inches in diameter. A few trees of *Conocarpus erectus* are found in among the *Avicennia* and these trees are without pneumatophores.

A portion of the northwest corner of the Isle of Ronde has been under cultivation at some time in the past. A few small houses exist there today and foundations of larger buildings may be seen. The current vegetation in that area is a sparse thorn shrub dominated by *Acacia nilotica, Leucaena glauca, Pisonia fragrans, Celtis iguanaea* and *Pithecellobium unguis-cati.* Many common weeds were seen in this thorn shrub zone and several plants left over from previous cultivation. Weak scrambling plants such as *Desmodium tortuosum, Psychotria microdon, Alternanthera ramosissima, Plumbago scandens, Pisonia aculeata, Sarcostemma clausum, Heteropteris purpurea* and *Cordia curassavica* are abundant.

Scattered areas along the western side of the Isle of Ronde are in cultivation at the present time or show signs of former cultivation. Among the plants persisting after cultivation and in part maintained at the present is an acre patch of *Panicum maximum.* This grass occurs in definite, man-made areas and also occurs sporadically on hillside openings. The grass is pulled by the roots and the clumps, with the roots inward, are laid in an ever-increasing spiral pattern to dry in the sun. When dry the clumps are used for thatch roofing.

The steeper hillsides and the rocky outcrops along the western side of the island have never been cultivated and show a relatively undisturbed vegetation comparable to that found on parts of the eastern coast. These are mainly soft or fleshy leafed plants in contrast with the spiny vegetation appearing on old fields. In addition to the *Jacquinia-Tabebuia* elements of this undisturbed vegetation there are *Coccoloba venosa, Casearia bonairensis, Ficus laevigata* and *Wedelia Jacquinii. Phoradendron trinervium* with attractive red-orange fruits was found growing on specimens of *Pisonia fragrans.*

In the southwest corner of the island there is a peculiar rock formation visible from the sea and many parts of the island. From a distance this appears to be an old windmill tower, but

it is actually a pile of tremendous boulders. These huge rocks appear to be consolidated and bedded tuff and some of the largest of these perched boulders are 20 feet in diameter. The vegetation around them is sparse on the rock outcrop and the only unusual plant is a small stand of *Phlebodium aureum* growing on the rock in crevices.

Kick 'em Jenny

While this island is known as Diamond Head in a few references and maps of the Grenadines, the local name and that most commonly in use at the present time is Kick 'em Jenny. This colorful name is attributed to the local sailors who challenge the viciously mule-like and dangerous tides which sweep by the island with the call of "Kick 'em up, Jenny!"

Kick 'em Jenny is a pile of boulders about 670 feet high and perhaps a quarter of a mile in diameter at the base (plate 7). The only landing spot on the island is a steep slope of small boulders, 10–20 inches in diameter, located on the southwest corner of the island. The remainder of the periphery is a wave-cut cliff. The approach to this landing spot and the actual landing are both dangerous because of the swift currents that flow past.

Directly above the landing area is a small cove, the only flat area on the island. Ascent of the hill itself can be made by circling the island from the south to the east. The climb is a difficult one and no trails are evident.

Kick 'em Jenny has never been occupied by permanent residents. Natives of other islands visit Kick 'em Jenny on occasion searching for birds' nests and eggs or hunting the wild goats and chickens which abound on the island. As we ascended the hill we saw nearly 100 goats of all sizes bound away. Sea birds of all kinds were disturbed from their resting places and the sailors accompanying me collected both eggs and young birds for food. The rocks at the top of Kick 'em Jenny were white with guano.

At the crest of Kick 'em Jenny I found a few gnarled trees. *Ficus laevigata* was most abundant, with specimens of *Eursera Simaruba*, *Pisonia fragrans*, *Capparis odoratissima* present and the whole overgrown with *Acacia tamarindifolia.* The rock outcrop on the east is covered with *Aechmea lingulata* and in other areas *Erassavola cucullata* and *Epidendrum ciliare* are present in considerable quantity covering the rocks. *Passiflora suberosa* and *Cissus sicyoides* are the most common vines. *Tillandsia utriculata* and *Tillandsia flexuosa* are present in all of the trees.

Immediately below the crest of the hill there is an open area that appears from the sea as a grassy meadow. Actually the area is of large loose boulders overgrown with pure stands of *Cyperus planifolius* and *Cenchrus echinatus*, the latter so dense the branches are almost erect. Interspersed in this area are low plants of *Cnidoscolus urens*, *Tecoma stans* and *Wedelia Jacquinii*. A few areas are dominated by *Plumbago scandens*. The middle elevations of Kick 'em Jenny, particularly on the western side, abound with *Cephalocereus nobilis*, *Pisonia fragrans* and *Croton flavens*. A few shrubs reach the edge of the sea cliff on all sides, these being mostly *Coccoloba venosa*, *Cassia Tora*, *Cordia curassavica* and *Solanum racemosum*. These areas just above the wave-cut cliffs show the greatest effects of the browsing of the goats. It is on these areas that the greatest development of weeds occurs, with *Bidens cynapiifolia*, *Callisia repens*, *Cynodon dactylon*, *Commelina elegans*, *Boerhaavia erecta*, *Sesuvium Portulacastrum* and *Dactyloctenium aegyptium* being most abundant. Many of these weeds appear elsewhere on the island, with *Commelina elegans* often forming mats on some of the exposed rocks.

The small cove above the landing area is well protected and it appears that the goats congregate here in stormy weather. Two large trees of *Coccoloba uvifera* grow in this area, while *Croton flavens* and *Tecoma stans* form a growth of shrubs. The rock faces support *Hylocereus trigonus* and an occasional specimen of *Plumeria alba*. On the wave-cut cliff faces there are scattered specimens of *Cactus Broadwayi* and *Portulaca quadrifolia*, and *Portulaca oleracea* grows in crevices or holes on the cliff face.

Carriacou

Carriacou is the largest island of the Grenadines in the Grenada territory. It is seven miles long and three miles wide at the broadest point. The island is irregular in shape with a ridge running the length of it. The ridge averages 750 feet in height with the highest point, a hill at the northern end called High North, reaching 850 feet above sea level.

Carriacou is the seat of government for the southern Grenadines. The larger of the two villages on the island is Hillsborough. The total island population is estimated at 1889 people. This is a mere fraction of the population of 6000 people which were on the island in 1836 at the height of the slave agriculture. Hillsborough has several stores, branches of larger stores in St. George's, Grenada, and two churches.

This island is still prosperous, due to its successful cotton crop. Small amounts of pigeon peas and peanuts are also grown for export. Local market gardens can grow excellent vegetables in season, chief among them white and sweet potatoes, yams, tannias, tomatoes, cabbage, carrots and lettuce. At the southern end of the island a partially abandoned lime plantation still exists. Some fruit is still gathered and juice and oil are extracted locally in a small mill. The plantings of lime trees are in poor condition, however, as the plants and fruits are affected by scale-insects and various mildews.

In the past century Carriacou has produced first sugar and then cotton and limes as the principal crops. Sugar is no longer grown on a commercial scale and the lime industry will not last much longer. Cotton still does well on the island, but the amount is only a small fraction of what was previously grown. Throughout the island one finds ruins of massive old houses, windmill towers (plate 24) which were used in grinding cane or ginning cotton, and even old irrigation ditches.

Water is still a problem on Carriacou. According to the oldest reports of the island the land was once forested and sugar was grown only at the lower levels. The irrigation system was established prior to 1800 and was used to conduct rainwater from the hills into the cane fields and later into the lime plantings. At the time of the abolition of slavery in the Grenadines in 1836, the supply of water was becoming a problem and cotton replaced cane as a crop for the small freeholders of the area. In 1891, according to Dr. Nichols' diary, water was in such short supply that it was necessary to import water for human consumption from Grenada. In 1891 a few wells were sunk to obtain ground water and it was found at a depth of 37 feet on the southern part of the island. Later reports in the early 1900's related that the wells were no longer producing water. At the present time a few wells are to be found on the island of Carriacou but these are not dependable throughout the year. Water catchment areas have been established and each house has its own tank and collecting system. Lack of water remains one of the chief problems of agriculture on the island.

A small botanical garden was established on Carriacou within the limits of the town of Hillsborough. This garden, according to a report of the oldest inhabitant of the area, was under the supervision of the botanical garden in St. George's, Grenada. I have been unable to find any records of when or why this small garden was established. It still has a caretaker and a few

interesting ornamental trees now of considerable age. The garden for all practical purposes has been abandoned, with only a series of citrus plantings remaining. Several unusual varieties of *Carica papaya* have been maintained and the garden does supply a small quantity of fruit for the local market.

Another area in the middle of the island has been designated as a forest reserve and is under the supervision of the forestry officer of Grenada. A local forest warden and several forest guards are assigned to the area to prevent the inhabitants of Carriacou from cutting wood in the area. This area is of recent designation and the results of protection are scarcely evident.

The agriculture of a century ago covered practically all of the lands on Carriacou. Nichols ('91) reports cotton fields extending from the town of Hillsborough to the top of the ridge and continuous to the eastern coast and extending from one end of the island to the other. Shallow shoal soils are found on the ridge and some crops are grown on the ridge itself today. The eastern slopes, especially around Dumfries and Mt. Pleasant, are planted in cotton. There are lime plantations at Harvey Vale at the southern end of the island. The southwest corner is cultivated in cotton, pigeon peas and peanuts, with large areas reserved for grazing lands. Near Limlair on the northeast corner there is also some cotton grown.

Retreat Bay on the southwestern peninsula of Carriacou is well known through the Lesser Antilles for the oysters which grow on the aerial roots of the red mangrove located there. Reference to these tasty oysters was found in travel books published in 1850. • At the present time the supply is reduced and one has to search for the oysters; nevertheless the publicity continues (Mitchell '49, pl. XIII) and one hears of the Carriacou oysters from Port-of-Spain to Roseau.

The red mangrove in Retreat Bay is a marginal formation not more than 100 yards wide. South of the town of Hillsborough, however, there is an extensive swamp. In 1861 this swamp was a mile long and half a mile wide and was open to the sea at the southern end. Now the entrance is blocked by an extensive sand bar and the swamp is filling in and drying out rapidly. The mangrove is being cut for fuel and the swamp has been reduced to one quarter its former size. *Rhizophora mangle*, *Avicennia nitida*, *Laguncularia racemosa*, and *Conocarpus erectus* were all found in the swamp.

The coast of Carriacou is largely coral or shoal formations and is wave-cut in the majority of places. Manchineel Bay and

Carenage Bay near Harvey Vale have limited areas of beach, spectacular because they are of black sand formed from volcanic rocks (plate 9). In the retreating waves these beaches glisten like polished ebony and the drift of sargassum, *Thalassia*, and the various succulent beach plants stands out conspicuously against the black.

By contrast the beaches at Grand Anse on Hillsborough Bay are of white coral sands. While the limited black sand beaches support an *Avicennia* plant growth, those white beaches on the western side of the island are dominated by *Hippomane, Coccoloba uvifera* and *Erithallis fruticosa.* Some specimens of *Caesalpinia Bonduc* scramble over the shrubs. *Crotalaria verrucosa* is a conspicuous blue-flowered herb in this beach association.

The inland vegetation of Carriacou in 1950 was diverse and consisted largely of pan-Caribbean weedy shrubs. Some of the most recently cultivated fields are solid stands of *Croton* spp. while older fields from the standpoint of abandonment show the typical spiny *Acacia-Albizzia-Pithecellobium* association. In the windswept rocky areas the soft shrub vegetation consisting of *Tabebuia-Jacquinia-Pisonia fragans* occurs. Coastal windswept grassland savannahs of *Cynodon, Pectis humifusa, Alternanthera* and *Evolvulus* are of limited occurrence.

Dr. Nichols visited Carriacou in May of 1891. This competent naturalist made the following comments on the vegetation: "There are no large indigenous trees in the island so that timber is pretty expensive and most of the people are poor. The roads are good and as no rain has fallen for a long time there is a drought in the land. In riding along this road (Hillsborough to Top-hill to Bellevue) one could get a very good idea of the indigenous vegetation. Except in the case of the silk-cotton trees and the tamarind and other trees introduced into the West Indies there are none of great height or girth. Dr. Durant told me that white cedar and other native woods are cut by the people as soon as ever they attain a size sufficient to be worked up owing to the scarcity of timber. In my rides about the island I noticed the following trees which will give one an idea of the vegetation. *Pithecellobium filicifolium, Hymenaea coubaril, Tecoma leucoxylon, Jatropha curcas, Cordia sulcata, Acacia farnesiana, Acacia nilotica, Terminalia catappa.* There were also a few coconut palms and *Creodoxa oli.acea* trees were abundant. And by the seaside one found the *Chrysobalanus icaco* and *Coccoloba uvifera.* The whole place was so burnt up that weeds and flowering herbaceous plants were conspicuous by their absence,

and one could judge the vegetation only by the trees and shrubs. *Furcraea cubensis* and an *Agave* which I take to be close to *A. rigida* were very abundant."

Tecoma leucoxylon is today known as *Tabebuia pallida*. However none of the recent collectors have reported *Cordia sulcata* or *Pithecellobium filicifolium*. *Chrysobalanus icaco* was not seen in strand vegetation and the population of *Oreodoxa oleracea* has been reduced to about a dozen trees which are zealously guarded for the fruits, which are used as pig food.

John Beard visited Carriacou in his studies of the Lesser Antillean forests and made a line transect through the forest reserve from Hillsborough to Top-hill, crossing the main road in that transect (Ox. For. Man. **21:** 146–7, 1949). This is essentially the same route Dr. Nichols followed 50 years earlier. I was able to follow Beard's route in 1950. His transect passed through old cultivated fields near Hillsborough where the vegetation was thickets of *Haematoxylon campechianum, Lonchocarpus Benthamianus* and *Swietenia mahogani*. Partway up the hill, however, Beard encountered a tall woodland, about 60 feet tall, of almost pure mahogany which he considered to be a pioneer community on old agricultural land. The rest of the line transect passed through what Beard regards as a relic of the original open forest varying from 60 feet high in protected spots to about 20 feet at the windswept crest.

Beard reports the dominants in this open woodland to be *Bursera Simaruba, Brosimum alicastrum, Pisonia fragrans, Ficus lentiginosa* and *Lonchocarpus*, cited in order of frequency. Smaller trees enumerated were *Capparis cynophallophora, Eugenia monticola, Coccoloba venosa, Trichilia hirta, Citharexylum* and *Amyris elemifera*, also cited in order of frequency. I question the identity of *Coccoloba venosa*. In my own study of this woodland I encountered a great deal of *Coccoloba caribaea*, a small tree which was the dominant in many areas, but no material of *Coccoloba venosa* was seen. I have not seen any of Beard's collections to check the determination. Beard also reports that other trees noted in the forest reserve but not recorded in the line transect were *Hymenaea Courbaril, Albizzia caribaea, Cordia alliodora, Mastichodendron foetidissimum, Carpodiptera floribunda, Genipa americana, Tabebuia pallida* and *Tamarindus indica*. To this list of occasional dominants *Piscidia piscipula* should be added. He further cites the following small trees: *Dipholis salicifolia, Casearia guianensis, Daphnopsis caribaea, Swartzia simplex* and *Tecoma stans*. These latter small trees

should be indicated as rare. Beard reports the shrub layer to be dense and consisting of small specimens of *Coccoloba*, *Dipholis*, *Capparis*, *Eugenia*, *Amyris* and *Trichilia* with the addition of *Schaefferia frutescens*, *Chomelia fasciculata*, *Erythroxylum squamatum*, *Aegiphila martinicensis*, *Pithecellobium unguis-cati*, *Guettarda parviflora*. I did not see any material referable to *Erythroxylum squamatum*, and *Aegiphila martinicensis* was definitely rare. To Beard's list of common shrubs I would add *Bunchosia nitida*, *Rauwolfia Lamarckii*, *Capparis coccolobifolia*, *Malpighia punicifolia* and *Eupatorium odoratum*.

Beard mentions the paucity of ground cover except on the rocky outcrop at the crest of the ridge. Here dense stands of *Aechmea lingulata* and *Callisia repens* occur. The former plant occurs either as a terrestrial plant on rocks or with equal frequency as an epiphyte on trees. *Tillandsia utriculata* and *Tillandsia flexuosa* also occur as epiphytes. Beard cites *Acacia tamarindifolia* as a common climber which it is. In addition one encounters numerous plants of *Gouania lupuloides* and *Pisonia aculeata* as tough or woody vines with the herbaceous vines, *Tragia volubilis*, *Matelea maritima*, *Chaetocalyx scandens*, *Ipomoea dissecta* and *Passiflora suberosa* very abundant in some areas.

Two relatively rare or unusual plants were found on Carriacou. *Morisonia americana*, the Jumbie sapodilla, was a 15-foot tree on the wind-blown crests near the south end of the island. The only other plant of this genus and species was found on the Tobago Cays. In one of the several ponds or catchments found on Carriacou the surface of the pond was covered with *Lemna perpusilla*.

Petit Martinique

About three miles due east of the northern end of Carriacou is a group of three small islands called Petit Martinique, Petit St. Vincent and Petit Tobago. The last island is frequently referred to as Petit Nevis by the people of Carriacou, although that name has never appeared in print.

These islands are supposedly named for their resemblance to the larger islands of the same name, Petit Martinique resembling Mt. Pelée of Martinique in appearance and the western hill of Petit St. Vincent resembling the Soufrière of St. Vincent in the exposed black volcanic boulders comprising that hill. I was warned by several of the inhabitants of Carriacou that the fer-de-lance occurs on Petit Martinique and was later told in St. Vincent that the occurrence of that snake on this smaller island

led to the adoption of the name. No snakes were seen on Petit Martinique and repeated questioning revealed no one had ever seen or heard of the snake on the island although "it occurred here years ago." One of the early guide books of the Caribbean attributes the name to Père Labat, who named the island for the occurrence of the snake there. Kew Bull. 1893, p. 231, reports that the island of Bequia was called Petit Martinique at an early period because of the occurrence of the fer-de-lance on that island. It appears that the story has become completely jumbled in the last century.

Petit Martinique is the largest of the three islands and the only one inhabited at present. Petit St. Vincent and Petit Tobago are both privately owned and at present are used only to graze stock.

These three islands are apparently on the same submarine shelf and associated with the island of Carriacou. A fringe of coral reefs surrounds the group on the eastern side, running in a curve along the north coast of Petit St. Vincent and extending westward almost to Carriacou (plate 10). A deep water channel about six miles wide separates the extensions of this reef formation from the island of Union. According to the 1860 Admiralty navigation chart of the Grenadines a 15-fathom channel ran between these islands and Carriacou, but today that channel is tortuous and can be traversed only under the most favorable circumstances. A strong tide flows through this channel and builds up and tears down with seasonal regularity a series of sand bars and islands, making navigation difficult. The largest of these was 100 yards long and 10 feet above sea level in March, 1950.

Petit Martinique is a conical island almost round in outline and reaching an altitude of approximately 800 feet. From the sea the upper 100 feet of the island appears wooded and is preserved as a forest reserve "to conserve the water supply of the island and to prevent erosion." A long sloping beach on the northwest corner of Petit Martinique affords an easy landing place for small boats. That beach area is delimited internally by a ring of the manchineel with only an occasional plant of *Coccoloba uvifera* and a few shrubs of *Erithallis fruticosa*. The remainder of the shore line consists of wave-cut cliffs.

Immediately behind the *Hippomane* fringe on the western side is a low flat of cultivated soil. This area is now planted regularly in sweet potatoes and peanuts, which do well in the sandy soil. Since this soil is considered rich, the only building in this area is

a schoolhouse. *Cryptostegia grandiflora* has escaped from cultivation and invaded this alluvial plain and is spreading rapidly. The most abundant weeds in the area are *Portulaca oleracea*, used as a cooked green vegetable, *Crotalaria verrucosa* and *Crotalaria retusa*, *Stachytarpheta jamaicensis*, *Heliotropium curassavicum* and *Heliotropium indicum*, all regarded as attractive plants and pulled only when cultivation demands it or for use as home decorations. Directly behind this alluvial plain the island rises sharply in a steep shoulder and then continues gradually on a 20–30-degree rise to the summit of the hill. A group of about 30 houses and out-buildings are clustered on the north side of the hill at the edge of the shoulder. Most of the land is owned by a single family.

From the shoulder at the base of the hill to the lower limits of the forest preserve the land is cultivated on all but the southern slope (plate 10). This land, as well as the alluvial plain, is considered to be fertile soil, with a lack of water being the only handicap for extensive and continuous agriculture.

The slopes of Petit Martinique are planted primarily with cotton and in some areas with lesser amounts of pigeon peas. A few areas are now used as pasture for cattle and goats and it was reported the grazing area has been rotated in the last few generations. The pasture lands consist primarily of *Distichlis* and *Dactyloctenium*. The area currently used for pasture is punctuated by outcrops of boulders and shallow soils which can be spotted easily by the shrub or woody growth. Shrubs occurring on these outcrops consist primarily of *Jacquinia* and *Hippomane*, which resist the salt spray, and *Randia* and *Piscidia*, more readily noticed by the gray appearance of the leafless or dead branches affected by the prevailing winds. Lesser amounts of *Croton flavens* occur as younger plants, along with *Jatropha gossypifolia* and *Rauwolfia Lamarckii*. These young plants are invariably growing in the shelter of growths of *Opuntia Dillenii*. A few old and quite large specimens of *Calotropis procera* were seen on the pasture areas and occur quite abundantly among the houses and on the alluvial plain.

The so-called forest reserve was readily explained once the climb was made to it. At a distance it seemed unusual that the limit of cultivation stopped where it did, but close examination revealed that erosion had completely removed all the soil at the crest of the hill and the top 100 feet of Petit Martinique is a pile of large boulders covered with a scanty vegetation. Since fuel is definitely a problem on the island, the inroads of the native

population on this forest reserve are very evident. The only trees in the area are distorted by the strong prevailing winds and lack the lower branches, showing signs of machete work. *Bursera Simaruba* is the most abundant, the largest trees being 30 feet tall and two feet in diameter and located on the lee side of the crest. A few small specimens of *Hippomane Manchinella* occur even at this highest elevation. *Tabebuia pallida* is represented by a few dozen trees, and both the one-leaflet and three-leaflet expressions of this species are present. *Ficus laevigata* is represented by a dozen trees, all more or less tumbling over the rocks with a weak scandent habit and only erect or horizontal branches.

The wooded crest of Petit Martinique is dominated more by shrub growth than by forest trees. *Coccoloba caribaea, Capparis baducca, Capparis odoratissima, Bunchosia nitida, Cordia globosa, Cordia curassavica, Wedelia Jacquinii, Trixis radialis, Bauhinia ungula, Bourreria succulenta, Tecoma stans, Anthacanthus acicularis, Pithecellobium unguis-cati, Schaefferia frutescens, Lantana reticulata* and *Abutilon umbellatum* make up this shrub cover, growing in between the exposed boulders. *Cnidoscolus urens* is painfully abundant throughout the shrub growth with plants varying from one to eight feet in height. *Opuntia Dillenii* and *Cephalocereus nobilis* are present.

In addition to the spiny plants mentioned, *Celtis iguanaea* grows abundantly on the crest. The plants are about five feet tall but have trailing or scrambling, sharply armed branches fifteen feet long penetrating through the brush growth, making progress difficult. *Plumbago scandens, Trichostigma octandrum, Matelea maritima, Solanum lancifolium, Cardiospermum corindum, Ceratosanthes palmata*, and *Tragia volubilis* add to the profusion of viny growth.

The surfaces of many of the larger boulders are covered with growths of *Chloris inflata, Aechmea lingulata, Commelina elegans, Rivina humilis*, or *Justicia periplocifolia.* More scattered are the herbaceous plants, *Boerhaavia erecta, Capsicum baccatum* and *Alternanthera ramosissima. Tillandsia utriculata* is the only epiphyte and it is not so abundant as on other islands.

It is obvious from this listing of the species that the forest reserve on the island of Petit Martinique is a decimated woodland remaining only because there is no arable soil in that region. None of the plants growing there at the present time are even worthy of preservation as seed trees, and to be an effective control for erosion the limits of this preserve should be extended

downward at least two hundred feet. This extension onto cultivated land should be planted in more useful species of woody plants. Little evidence of erosion was found on the steep slopes of Petit Martinique and while no rainfall records are available for the island it is doubtful if the rainfall exceeds 40 inches.

Petit St. Vincent

Petit St. Vincent is a privately owned island and permission of the owner on Petit Martinique must be secured to visit it. The story is told that the pirates of past centuries buried their treasure on this island and while none has ever been found, the owner still jealously watches the island with a telescope to make sure no one digs for bullion.

The island (plates 10, 11, 12, 13) is about one-half mile long and several hundred yards wide. A sloping beach on the south coast serves as a landing place for small boats. Petit St. Vincent consists of four small hills, one on each end and two grouped together in the center. The central pair is separated from the hills at each end by low flat sandy areas. One of these is at sea level and was used at one time as a small salt flat. The other is above sea level, has some soil, and at various times in the past has been used to grow crops. In fact in 1831 cotton was grown on this small plot of land and the production was recorded in the court records in Carriacou.

At the present time Petit St. Vincent is uninhabited and only the remains of one small house are to be found. The island is used as pasture for numerous goats and a few sheep.

At the upper limits of the beach on the south coast are several large manchineel trees interspersed with large specimens of the sea grape. Except for this beach area on the south coast the remainder of the island shore consists of wave-cut cliffs.

The most unusual feature of Petit St. Vincent is the hill at the western end of the island. This hill is 275 feet high. From sea level to 100 feet altitude there is a small amount of soil covered with closely grazed specimens of *Dactyloctenium*. Erosion and gullying are evident on this slope with the deepest gullies three feet in depth. This is quite in contrast to the higher Petit Martinique where erosion gullies are nowhere evident. From a point about 100 feet above sea level to the summit at 275 feet, the hill consists entirely of bare piles of boulders, all sharply angular and black, appearing to be of agglomerated tuff with some larger volcanic fragments.

The only ground cover on these rock masses is *Abildgaardia monostachya*, occurring in tufts on or between the rocks. Not another herbaceous plant is seen on the ground and the hillside gives the appearance of an open park area. Immediately above the zone of soil and at the base of the rocky area is an open shrub formation of *Hippomane* and *Tabebuia* (fig. 12). The growth consists only of these two plants, but the *Tabebuia* is being cut rapidly for use in boat building. Growing on the pure rock the trees are contorted, nearly all specimens showing curvature at the base. This of course makes the ideal form for use in keels and ribs of the boats built locally. Above the *Hippomane-Tabebuia* zone the vegetation becomes more diversified but of the same open or park-like aspect. *Jacquinia*, *Bourreria succulenta*, *Tecoma stans*, *Calliandra purpurea*, *Plumeria alba*, *Capparis odoratissima*, *Lysiloma latisiliqua*, and scattered but fewer plants of *Parkinsonia aculeata* and *Jatropha gossypifolia* make up the shrub zone. On the flat summit of this western hill the park-like aspect of the vegetation is even more pronounced. Here the trees or bushes are 12–18 feet in height with no young plants or seedlings evident. The entire area is heavily browsed by goats which pull down the lower branches to eat the leaves so that the vegetation is trimmed to an even seven feet above the ground (fig. 13). *Jacquinia*, *Randia aculeata*, *Coccoloba caribaea*, *Croton astroites*, *Capparis coccolobifolia*, *Capparis indica*, *Forestiera rhamnifolia*, *Acacia macracanthoides*, *Maytenus elliptica*, *Amyris elemifera* and *Eugenia ligustrina* dominate this area, with occasional specimens of *Exostemma caribaeum*, *Casearia bonairensis* and *Citharexylum spinosum*.

Tillandsia utriculata and *Brassavola cucullata* were the only epiphytes seen, and *Doxantha unguis-cati* is the only vine in this association and on the island.

Between this western hill and the central pair of hills the vegetation also shows effects of browsing by goats. *Tabebuia pallida* once must have been abundant in this area along with *Hippomane* but the former has all been cut out except for a few much deformed trees. The open areas, once cultivated, have since been invaded by weeds and are now covered with *Waltheria americana*, various species of *Euphorbia*, and numerous specimens of *Heliotropium curassavicum*, and the whole is carpeted with *Dactyloctenium*. This same grass forms a solid cover over most of the central two hills, which are about 100 and 150 feet high. It appears that these peaks too were once cultivated lands and only occasional specimens of *Pithecellobium unguis-*

cati, *Jacquinia barbasco*, *Bourreria succulenta* and masses of *Opuntia Dillenii* interrupt the grass cover.

The eastern hill can be approached by a gradual slope covered with grass and scattered specimens of *Cordia tremula* or growths of *Bauhinia ungula* and *Cordia curassavica* which dominate local areas. Erosion is also evident on this slope and several of the eroded gullies show boulders of the type found on the western hill. Near the summit of this eastern hill which rises to 150 feet the soil has been completely removed, but instead of being covered with loose boulders this hill appears to be a solid rock mass. The crest is dominated by several low but widely spreading specimens of *Ficus laevigata* with no undergrowth. Around the *Ficus* specimens are scattered specimens of *Jacquinia* and *Bourreria* with occasional specimens of *Cephalocereus* mixed in.

The extreme eastern slope of this hill shows a typical wind-swept brush formation consisting of shrubby growths of *Pithecellobium* and *Jacquinia*, with *Andrographis paniculata* and a strong development of *Opuntia Dillenii* and *Cactus Eroadwayi* on the edge of the wave-cut cliff.

Anthacanthus acicularis was found in the Grenadines only at the summit of Petit Martinique and on this easternmost hill on Petit St. Vincent.

The substratum of Petit St. Vincent, consisting entirely of boulders eroded free of soil matrix and open vegetation with a park-like aspect, relatively free from vines and almost completely lacking herbaceous plants, suggests the ultimate appearance of many of the islands of the Grenadines. Petit St. Vincent, because of its small size and heavy grazing, has deteriorated faster than any other island in the chain. It was certainly a unique and interesting island from the point of view of a botanist.

Large Island

Within a distance of four miles south of the island of Carriacou is a series of small uninhabited islands. Large Island, about one-half mile square, is the largest of the group and within the last fifty years was heavily cultivated. A landing was made at a rocky cove on the western side of the island, the entire coastline being wave-cut cliffs, often with coral reefs near the island. No sandy beach exists on Large Island. The western half of Large Island is a plain sloping from 10 feet above sea level on the western coast to a plateau in the eastern half which is about 100 feet above sea level. A few connected and outlying rocks of con-

siderable size are to be found on the southeastern corner of the island.

The western sloping plain was once cultivated and the ruins of several large masonry buildings, including a great house, still remain. Water for these habitations must have been collected in the many pits dug in the coral rock comprising the island. A small catchment pond, obviously for stock, exists near the middle of the northern coast. While the island is at present uninhabited, it is used as a headquarters for fishermen of the area. Lobster and fish traps under construction and past repair were scattered around. Live stock consisting of burros, sheep and goats were seen and wild chickens were extremely abundant.

The crops of the formerly cultivated areas were primarily cotton, pigeon peas and sugar cane, and a few surviving plants still remain. However the most recently cultivated fields have been reclaimed by pure stands of *Cnidoscolus urens*, *Croton flavens* and *Opuntia Dillenii*. The plants of *Cnidoscolus* present an almost impenetrable barrier. These are old, well-established growths of shrubs reaching 8 feet in height and 4–6 inches in diameter at the base (plate 14). The *Opuntia* stands are well developed but almost hidden in the lush growth of various grasses. Interestingly enough, all of these areas are well marked. It appears the fields were abandoned at different intervals and each was reclaimed by a single species which completely occupied and dominated that field. Nowhere else in the Grenadines were such formidable stands of *Opuntia* and *Cnidoscolus* encountered.

The areas surrounding these old cultivated fields are open, park-like formations of *Hippomane*. The individual trees are 15–25 feet tall and have a diameter of 1–2 feet at breast height. This area is slightly lower than the old cultivated area and the moist soil appears to be saline. One portion of this manchineel flat is hollowed underneath with a wave-cut cave, and several spout holes were seen. It appears that during storms the waves not only dash salt water over the coastal cliffs but also much water is spread on this flat through the spout holes and the undercut caves.

Immediately around several of the ruins of old buildings there are extensive growths of *Aloe vera*, an escape and remnant of former cultivation. Other old cultivated areas on the island have grown up with a variety of weedy plants—*Malachra alceifolia*, *Ruellia tuberosa*, *Cassia Tora*, *Alternanthera polygonoides*, *Cordia curassavica* and *Evolvulus glaber*.

The plateau area on the eastern side of the island is a tremendous pile of very large fractured rocks. Most of these square-sided boulders are 12 to 50 feet in dimension. I suspect that this was once a large rock mass broken by some seismic movement in the past. The central part of the plateau has a very shallow soil but there is no evidence that this area has been cultivated. It proved to be the principal grazing area of the burros now roaming free on the island and may well have always served as a pasture land. Surrounding this slightly depressed center is a ring of exposed boulders all covered with an open formation. Plants found in this growth include *Acacia nilotica*, *Pithecellobium unguis-cati*, *Randia aculeata*, *Pisonia fragrans*, *Ficus laevigata*, *Citharexylum spinosum*, *Capparis baducca* and *Capparis odoratissima*, *Bursera Simaruba*, *Coccoloba caribaea*, *Hippomane Manchinella*, and scattered plants of *Plumeria alba*. *Plumeria* is more abundant on the coastal edges of these rock piles and on the outlying rocks at the southeast corner of Large Island. *Cactus Broadwayi* also occurs on the coastal edges, while *Cephalocereus nobilis* is very abundant in restricted areas in the wooded formation. *Banisteria purpurea* is perhaps the most abundant vine, and *Cissus sicyoides* is common. An unusual Asclepiadaceous vine, *Marsdenia macrophylla*, was found in the interior area of this plateau and was not seen elsewhere in the Grenadines. *Tillandsia utriculata* proved to be the only epiphyte seen.

White Island

White Island, one of the smallest of the islands lying south of Carriacou, was also one of the most unusual seen in the Grenadines (plates 22, 23). We approached White Island from the southwest, sailing from Large Island. The island appeared to consist of a sharply folded mass of black rock perhaps 200 yards in diameter at the base and reaching a height of 150 feet. The formation of this rock is best seen from the sea from the southeast corner. At this point the wave action has removed by undercutting much of the rock, and the apex of the folds is clearly visible. The rock is fractured into tall columns or pillars, each proving to be about one to three feet in diameter and hexagonal in section. Many of these pillars of rock extend fifty feet in the air and a few are standing free from the mass of the rock ready to be toppled in the next heavy storm. Those that have already broken lie in a heap at the wave-washed base.

Extending north-northwest from this pile of rock is a sandbar of irregular shape about 300 yards long and an average of 100

yards wide (plate 23). Because of numerous coral reefs and the tricky currents it was possible to land in only one place, slightly to the lee of the northern tip of this bar. Even there the beach graded very sharply.

The sand bar consists of coarse coral sand and broken shells. Large coral fragments are present throughout the sand bar, some buried and others lying exposed on the surface. The coral sand bar has a dense fringe of vegetation (plate 23) which consists primarily of *Coccoloba uvifera* in its juvenile form with many long adventitious shoots. *Suriana maritima* is growing in among the sea grapes. This was one of the very few places I encountered this common beach plant of the Greater Antilles in the Grenadines. Earlier collectors report it from other islands of the Grenadines, however. Also in the marginal fringe of *Coccoloba* I encountered *Lantana involucrata, Bourreria succulenta, Conocarpus erectus,* and a few specimens of *Tabebuia pallida.* Many of the specimens of *Coccoloba uvifera* were heavily parasitized by *Cassytha filiformis,* conspicuous by its bright orange color and white fruits.

In the interior of this sand bar plants of *Coccoloba uvifera* were scattered and in between these trees I found *Tournefortia gnaphalodes, Heliotropium indicum, Heliotropium curassavicum,* and *Euphorbia buxifolia.* The open sandy areas were occupied with scattered plants of *Stachytarpheta jamaicensis* and *Phyla nodiflora.*

While this list of species seems to be very common to one familiar with the vegetation of the Greater Antilles or the Bahama Islands, it is decidedly unusual in the Lesser Antilles and the Grenadines. This was the only beach area of its kind that I found in the Grenadines and the only spot where all of these plants occurred in the association so familiar farther north.

Approaching the base of the rock pile from the sand bar, one encounters a sudden change in the vegetation (plate 22). A deep pile of leaves has accumulated at the junction of the rock and the sand, making the initial ascent of the rock a treacherous one. The lower level of the rock pile consists of black, irregular, angular rocks which have tumbled from high elevations. This pile of loose rock is overgrown with spreading, tangled formations of *Ficus laevigata.* The long trailing aerial roots and branches which droop and trail over the loose rock make travel difficult. This lower growth of *Ficus laevigata* is vividly recalled by the start I received in encountering a dozen 2–3-foot iguanas (*Iguana iguana iguana*) on the lower limbs of the tree. The animals apparently encounter other life so rarely they were unafraid and it

was only our stumbling progress over the loose and sharp rocks that aroused them. When startled, they dropped to the rocks and disappeared in among the loose rocks or climbed the rock pile with amazing speed. The lizards had been feeding on the ripe yellowish fruits of the fig. To this I attribute the distribution of numerous seedlings of the *Ficus* which I found all over the surface of the rock pile. Mixed in with the fig at the base of the hill are occasional specimens of *Pisonia fragrans*, *Capparis odoratissima*, *Rauwolfia Lamarckii* and *Cephalocereus nobilis*.

The lower slopes of the hill present a difficult tangle of climbing branches of the fig, but once these are passed the rock pile is relatively free of vegetation. The climb to the top of this rock pile was made by steps over the truncated ends of the hexagonal pillars exposed in a series along the north and west slopes of the hill. Signs and a few bleats indicated there were some goats on this island, but none were seen during the ascent. Near the very top of White Island I encountered a clump sedge which had been browsed by the goats. It is a different species from any given in the following list but could not be identified. The crest of the hill showed some loose rock but in many cases the pillars of rock curved over the top and descended the eastern side where they had been broken far below by the action of the waves. A few specimens of *Plumeria alba* and several of *Cephalocereus nobilis* were the only plants I encountered on the summit.

From the top of White Island one can get a good view of Saline Island to the east about half a mile. The salt pond previously used was visible.

While I could not adequately interpret the geology behind the formation of this folded pile of pillared rock, the combination of strand plants, figs, rocks and iguanas made White Island well worth the visit.

Union Island

Union Island, although small, is the most rugged in relief of all the Grenadines (plates 6, 8, 18). The island is irregular in outline, a little over three miles by two miles in its longest dimensions with two very abrupt ranges of hills dominated by the Pinnacle, which reaches 1010 feet above sea level, the highest point in the Grenadines.

The irregular coastline has many bays which unfortunately are shallow with table reefs at the coast, as in the case of Chattam Bay on the west, or ringed and guarded by surface reefs with only small entrances, as at Clifton and Ashton harbors. Only

the smallest boats can enter these harbors and lightering is necessary for most cargoes entering or leaving Union Island. Entrance to Clifton harbor, the seat of government for the Grenadines of St. Vincent territory, is marked by two lanterns, one on the dock and one in the hills behind the town. With adverse currents this tricky entrance is impractical and permission for departure at night is not granted because of the reefs.

Since Union Island is the southernmost of those islands of the Grenadines under the jurisdiction of St. Vincent, it has been mentioned frequently in the few references to the Grenadines in the early published literature on the area.

Shephard reported in 1831 that 2150 acres of land were under cultivation on this island, all by one proprietor. He wrote that there were 395 slaves on the island and that the cotton production at that period was 47,000 pounds. Ober (1879) described Union from the sea as "black and gloomy from the east indicating a virgin vegetation and little cultivation." Ober apparently did not investigate further, for Nichols in his diary reports that in 1891 the cotton crop of Union Island was 34,200 pounds. At that time the entire island was owned by a single family which leased out the land on the metayer system.

Nichols in 1891 landed at the harbor of Clifton and made the overland journey to the town of Ashton, one mile away. In quoting his comments on the vegetation, I have placed in parentheses the current name for the species he mentions:

"Just behind the beach at Clifton was a thicket of manchioneel (*Hippomane Manchinella*) and sea side grapes (*Coccoloba uvifera*) and beyond them the land was somewhat marshy and riddled with crab holes. Further inland was a stubble of cotton bushes, the crop having been reaped. We wended our way through the marshy land and ascended the hill on which Clifton House stood. The vegetation composed primarily of *Lantana camara*, wild black grape, *Cordia* sp. (probably *Cordia curassavica*), *Capsicum baccatum*, *Plumeria alba* and the floor carpeted by a small plant called turtle weed (*Trianthema Portulacastrum*) because the turtles feed on it. We skirted a rounded promontory passing along a goat track which served for a road and then descended to the shore and rode through swampy land covered towards the sea with mangroves. Farther out seawards across a muddy flat were large clumps of mangroves. The swamps in this place must cover fully a hundred acres of surface and on dark nights they are dangerous. A few months ago the Anglican clergyman of the place, a certain Rev. Mr. Donowa, a dark colored man lost

his life owing to exposure in these swamps. It is said that night a syren lured him on and left him to perish in the morass. He was rescued however after some hours, his cries having attracted the notice of a person passing along the road. He had sunk up to his armpits and in less than another hour he would have disappeared entirely. He died soon afterwards from the result of the exposure."

Dr. Nichols continues, "All along the road running up the hilly slopes was a great deal of wood but the trees were small, which is due to the constant cropping of wood to ship to Barbados where a good deal is consumed for fuel. A trade in fine wood is also done between Bequia and Barbados. Along the road as we neared Ashton white cedars (*Tabebuia pallida*) were plentiful and on one I got a fine clump of an orchid, *Brassavola cucullata*. Away up in the hills the long straight flowering poles of the so called aloe, *Furcraea cubensis* (*Agave caribaeicola*) were very conspicuous. On riding back I found the following plants in addition to those mentioned: 1. Tamarind (*Tamarindus indica*), 2. Opuntia (*Opuntia Dillenii*), 3. creeping cereus (*Hylocereus trigonus*), 4. *Aloe barbadensis* (*Aloe vera*), 5. *Cuscuta americana*, 6. *Capparis amygdalena* (*Capparis indica*), 7. *Capparis cynophallophora* (*Capparis odoratissima*), 8. a low Croton (probably *Croton flavens*), 9. *Solanum aculeatum* (*Solanum lancifolium*), 10. *Albizzia lebbek*, 11. *Acacia Farnesiana*, 12. an Erythroxylon (*Erythroxylum ovatum*), 13. *Tillandsia* (probably *T. utriculata*), 14. *Tabernaemontana* (probably *Rauwolfia Lamarckii*), 15. *Argemone mexicana*, 16. *Vinca rosea* (*Lochnera rosea*), 17. *Parkinsonia aculeata*, 18. Sour sop (*Annona squamosa*), 19. Sweet sop (*Annona reticulata*), 20. Lime (*Citrus aurantifolia*), 21. *Plumeria alba*, 22. *Tournefortia volubilis*, 23. *Ruellia tuberosa*."

Dr. Nichols' impressions are useful in understanding the current vegetation of Union Island, because they provide a clue to the rapidity of changes in the terrain and vegetation of the Grenadine area.

There is no evidence in the literature that sugar cane was ever grown on Union Island. Apparently cotton has always been the principal crop up to the present. Shephard's report of 2150 acres under cultivation indicates that almost every acre of land except the ultimate ridges and swamps was once planted in cotton and that the current vegetation has been at least 50 and perhaps as much as 120 years in developing. At the present time not more than 200 acres of Union Island are under cultivation and the principal industry of the island is raising of stock

Thus large areas are considered pasture. Cattle, sheep, goats and chickens represent the largest source of income for the majority of the current population. A few pigs are raised and some fishing is carried on. The current population of about 1500 people is no longer agricultural and most of the men spend some time in Trinidad or on Curaçao and Aruba working in the oil fields. With savings from these years of work they return to Union to settle down, open a small store, grow crops for their own use, or fish for sea food for their own consumption.

Union Island more than any other of the Grenadines seems to be a source of labor for the other large islands. The ready explanation for this is that the land is exhausted and has been for several generations. Humus is practically non-existent on Union. The top soil is poor and very shallow. Erosion is rampant due to past and present agricultural practices and lack of conservation measures. Bed rock or boulders are exposed everywhere. Agriculture is a practical impossibility.

Union Island remained in the hands of one or a few families practicing the metayer system of agriculture, which has exhausted the soil, from at least 1831 to 1910. Stone walls in the old ruins indicate the magnitude and excellence of the former residences on the island. The magnificent old house which Dr. Nichols called Clifton House on the promontory south of the town of Clifton is today the residence of the local district officer.

In 1910 the island was purchased from the owners by the government of St. Vincent, and today both the freehold and leasehold systems of land tenure are followed. What little agriculture is accomplished takes place around the town of Clifton, north of the town of Ashton in the valley head, and a little on the north coast. Sweet potatoes, pigeon peas, dasheens, and some cotton are grown.

The current export crop is Sea Island cotton, which by government decree must be pulled and burned by approximately April 15th. Since the cotton is planted and cultivated in vertical rows, erosion gets an early start. After pulling and burning the land stays bare for several months before a new crop of cotton is planted. While the soil on Union is very poor, the agricultural practices are allowing erosion to destroy what little value the soil still possesses.

Pure stands of *Leucaena glauca* and an association of *Rauwolfia Lamarckii*, *Croton flavens* and *Calliandra purpurea* seem to follow the abandonment of cultivation on the eastern end of the island, but recently abandoned fields in the Chattam Bay

area have grown up in a pure stand of *Malvastrum spicatum* (plate 15).

The western half of the island, especially the higher elevations, is today termed a forest reserve. There are few trees of any size in this area, the worthless *Ficus laevigata* and *Bursera Simaruba* being the largest ones. Generally speaking, the forest reserve area is covered today with a secondary woodland existing on dry shallow soil and having a thin open aspect, with the plants 15 to 30 feet tall. *Bourreria succulenta* is perhaps the most abundant plant on the island and in this woodland. Associated with it in dry shrub lands are *Pithecellobium unguis-cati*, *Erithallis fruticosa*, *Casearia decandra*, *Pisonia fragrans*, *Guettarda parviflora*, *Guettarda scabra*, *Coccoloba caribaea*, *Bunchosia nitida*, *Malpighia punicifolia*, *Erythroxylum ovatum*, *Eugenia ligustrina* and *Myrcia citrifolia*. *Pedilanthus tithymaloides*, *Wedelia Jacquinii*, and *Ditaxis lancifolia* form a shrub layer. All in all, this woodland forest reserve is uninteresting and without promise except as land cover. No plantings are made and nothing of commercial value is present.

The *Hippomane-Coccoloba* association immediately behind the beach at Clifton still stands fairly much as Dr. Nichols described it. The swamp area behind the beach has gradually filled in over the intervening period of years but is still a salt flat covered with a miscellany of weeds which are dominated by *Heliotropium curassavicum*. The area is wet and swampy during the rainy season but serves as a pasture land for sheep, goats and cattle during the dry seasons.

The hills between Clifton and Ashton from which wood was being cut for export in 1890 still have a low shrub vegetation. The local land records show that prior to Dr. Nichols' visit in 1891 this area had been cultivated. Thus, the period around 1890 probably represented a peak in the regrowth of vegetation in that area. The cutting in the years following 1890 again reduced the status of the vegetation. *Tabebuia pallida* is only occasionally found now, while this area is reported to have produced lumber for many of the boat-building industries of Union and adjacent islands around 1880. The principal species in this shrubland today are *Croton niveus*, *Croton flavens*, *Lantana involucrata*, *Cordia curassavica* and *Bauhinia ungula*.

Pinnacle Peak is the dominant geologic feature of Union Island. Approach can be made from the Clifton side through regions of pasture land interrupted in one place by a dozen specimens of *Caesalpinia coriaria*, the divi divi, which the natives

say was planted many years ago for its fruits. The fruits are still gathered and shipped to Trinidad, where they are used in tanning leather. Other pasture areas possess scattered trees of *Lonchocarpus Benthamianus* and *Acacia nilotica. Cordia obliqua* is also a common tree of pasture lands or areas of former cultivation.

The dry brush land of the adjacent rocky hilltop has a sparse vegetation with *Calliandra purpurea* dominating local areas and occurring with a mixture of *Pithecellobium unguis-cati, Parkinsonia aculeata, Randia aculeata, Bauhinia ungula* and several species of *Croton* occurring in other areas. The slopes of the Pinnacle are grazed to the base of the towering mass of rock, which has almost perpendicular sides. Ascent was made by climbing from rock to rock with the aid of roots of *Ficus laevigata* or by climbing in the rock crevices. The lower rocks are dominated either by a growth of *Comocladia Dodonaea,* specimens of which are fifteen feet tall with a trunk diameter of 4–6 inches, or by *Acacia macracanthoides.* A few specimens of *Pisonia fragrans, Clusia* sp., probably *C. alba, Tecoma stans, Capparis odoratissima, Capparis coccolobifolia, Leucaena glauca, Tabebuia pallida* and *Citharexylum spinosum* were found on the higher rocks, but near and at the summit the only shrubs were *Erithallis fruticosa* and *Plumeria alba.* At the crest one boulder was covered with a growth of *Polypodium polypodioides.* On the north side of the Pinnacle, on vertical walls, I found a large stand of *Pitcairnia latifolia. Epidendrum ciliare* was abundant on the rocks at all elevations, and *Tillandsia utriculata, Tillandsia flexuosa,* and *Brassavola cucullata* were the only epiphytes seen.

Many of the rocks at the summit of the Pinnacle were heavily covered with the limp hanging bodies of the lichen *Roccella caribaea* Darb. This plant looked like a clump of gray seaweed. Individual plants showed considerable variation in shape and thickness and the colony as a whole was evidently hygroscopic, with the outer plants showing signs of desiccation while the inner plants, closer to the rocks and the run-off of water, were extremely plump or turgid with moisture.

Even the summit of the Pinnacle had been visited by goats and all of the plants found there were browsed. Animals on Union Island are kept staked during the wet seasons of the year, but around the first of March is the start of the "let-go" season when all animals are turned loose. The poor quality and the general paucity of grazing land is evident in the general effects of browsing seen on all woody vegetation.

The mangrove swamp area, which Dr. Nichols described, between the towns of Clifton and Ashton is no longer 100 acres in extent, and is filling in rapidly by erosion of nearby hillslopes. The outer periphery of this swamp on the south coast still possesses a few plants of *Rhizophora mangle*, but the majority of the area is wooded with medium-sized plants of *Avicennia*. A large unvegetated plain exists between the *Avicennia* growth and the road which circles the foot of the hill. In March this area is dry, but during the rainy seasons water collects here, making a soft, mud-based lake. Nowhere in this area would it be possible for a man to sink to his armpits today.

On the central part of the north coast there is another *Avicennia* swamp area which is also filling in by erosion from the central ridge. Succulent weedy plants dominate the flat lands with several sprawling clumps of *Hibiscus tiliaceus* and an occasional plant of *Sophora tomentosa* comprising the woody vegetation. It is in this area that two small salt ponds have been operated in the past.

Prune Island

Prune Island, about one mile east of Union, consists of four low hills connected by low sand bars and mangrove swamp areas. From a short distance at sea Prune appears to be four disconnected hills. A good landing beach runs the length of the western coast, while the north coast is a shallow coral flat. The south and east coasts are protected by coral reefs, frequently exposed, and the two eastern hills are wave-cut along the coast.

Prune Island has been privately owned in the past but was acquired by the government of St. Vincent with the purchase of Union Island in 1910. Dr. Nichols reported in 1891 that Prune Island was then under consideration as a site for a leper colony, but the lack of water apparently canceled such plans. Between 1890 and 1910 the island was planted in cotton, but following the purchase by the St. Vincent government the island has been parceled out in small rental garden lots. The poor coral-sand soil is not too fertile and in recent years only small plantings of sweet potatoes have been made.

In 1946 the St. Vincent government proposed the construction of salt ponds on the island and that work had been started in 1950 (plate 26). A $2000 grant from the Colonial Development and Welfare Commission was obtained, and a man from St. Vincent was sent to the Leeward Islands to learn the operation. It is planned to have three large pans, two for concentration and

one for precipitation of rock salt, and a smaller pan for the crystallization of table salt. Because of the low tidal change it will be necessary to pump water into these beds. The area selected for these salt pans is a mangrove swamp consisting primarily of *Avicennia nitida*. These plants are being removed by hand labor. Since salt for curing fish is now imported from the Leeward Islands, it is hoped that this project will supply enough salt to make the St. Vincent Grenadines self-sufficient in this respect.

The flat lands which comprise the majority of Prune Island are mostly *Avicennia* formations. Toward the western end, where cultivation of sweet potatoes occurred most recently, this sand flat is now grown up in *Distichlis* grasslands. Hillslopes which were once planted in cotton are now almost pure stands of *Leucaena glauca*. The northern edge of the sand flat is growing up rapidly in a shrub association of young spreading plants of *Hippomane, Coccoloba uvifera, Rhizophora mangle, Conocarpus erectus, Lantana involucrata, Suriana maritima* and *Bourreria succulenta*. Interspersed with these young trees are lower shrubs of *Tournefortia gnaphalodes, Wedelia Jacquinii* and *Euphorbia buxifolia*, and the principal grass is *Distichlis*. These shrubs are frequently overgown with the climbing *Caesalpinia Bonduc, Passiflora suberosa* and *Solanum lancifolium. Cuscuta americana* grows on several specimens of *Coccoloba*.

Just back of the drift on the northern coast *Calonyction tuba* has become established. This is one of the few places in the Grenadines where this plant is seen. The shallow water of the coast is green with *Thalassia testudinum* and *Diplanthera Wrightii*.

The western hill of Prune Island is the one most protected from the prevailing winds. *Bursera Simaruba* is the only large tree on this dry hill, but the associated vegetation, shrubby and dense, consists of *Ficus laevigata, Leucaena glauca, Bourreria succulenta, Rauwolfia Lamarckii, Cnidoscolus urens, Capparis odoratissima, Lantana involucrata*, and the lesser herbaceous plants such as *Rivina humilis, Capsicum baccatum, Commelina elegans. Tournefortia volubilis*, a woody vine, is everywhere, and there are a great many plants of *Exogonium solanifolium*. This is the only place where *Exogonium* was found in the Grenadines. The extreme western face of this hill has many plants of *Cephalocereus nobilis* and a few plants of *Opuntia Dillenii* and *Agave caribaeicola*.

The three hills to the east or windward side are densely covered with a shrub vegetation which is windblown. At the extreme eastern end of each of these hills only the succulent low plants

which can stand frequent spraying by salt water are present. *Sesuvium Portulacastrum* grows in every hole in the eroded rock and *Pectis humifusa*, *Portulaca oleracea*, *Euphorbia prostrata*, *Cactus Broadwayi* and young plants of *Agave caribaeicola* are abundant. Westward with the prevailing winds, the vegetation slopes gradually in windblown rows of shrubby plants. *Randia aculeata* is one of the lowest of the woody plants building up a lee for plants of *Jacquinia barbasco*, *Tabebuia pallida*, *Erithallis fruticosa*, *Conocarpus erectus*, *Capparis odoratissima* and *Croton flavens*, which are less tolerant of exposure to salt spray. The more protected spots are dominated by *Bourreria succulenta*. *Opuntia Dillenii*, *Cephalocereus nobilis* and *Agave caribaeicola* are common in this windblown shrub. In one of the protected spots on the northeast hill there is a thicket of *Lycium Tweedianum* var. *chrysocarpum*, the only plants of this genus seen in the Grenadines and the first record of this plant I can find south of the Greater Antilles. At the time of my visit the shrubs were about five feet tall and practically leafless during this dry season.

Mayero

The spelling of the name of this small island varies in the literature and references to the Grenadines. Shephard (1831) calls it Mayera and the current spelling of the name throughout the adjacent islands is Mayerau. The majority of directories, however, spell it Mayero as used in this paper.

Mayero is an irregular-shaped, hilly island about 1.5 miles by 1 mile in its longest dimensions. Two ridges of hills averaging 200 feet run across the island, reaching a height of about 350 feet. Two natural bays afford landing space: the one on the west is a deep water bay where it is possible to tie boats directly to a dock; the northern bay is shallower, and beach landing is possible. The bay on the southeast side of the island is surrounded by coral reefs, making approach impossible. The remainder of the coast line consists of wave-cut cliffs.

The island has always been privately owned, although the current owner has offered Mayero and the Tobago Cays for sale. The metayer system of agriculture is used at the present time on Mayero, perhaps the only place in the Antilles today. The current population is around 200 people.

Cotton has been grown on Mayero since 1831, but erosion and the current poor agricultural practices have ruined the soil, and the crops are likewise poor. Lack of water is perhaps as great a cause for poor crops, and even drinking water must be brought

in during many months of the year when the two small catchment ponds go dry.

The island is heavily planted in cotton, with lesser amounts of pigeon peas and sweet potatoes. The fields are uncultivated and the crop plants are the poorest seen anywhere in the Grenadines (plate 28). They are small and hidden in the heavy growth of *Croton flavens, Malachra alceifolia, Eclipta alba, Melochia tomentosa* and *Cassia glandulosa* var. *Swartzii*. Signs of mineral deficiency are very prominent in the cotton.

In the past even the ridge sites on Mayero have been cultivated. When abandoned, they grew back in *Croton flavens, Croton niveus, Randia aculeata, Melochia tomentosa* and *Cassia glandulosa* var. *Swartzii*. Casual woody plants occurring in open cultivated fields include *Tamarindus indica, Leucaena glauca, Albizzia Lebbek, Wedelia Jacquinii* and *Opuntia Dillenii*.

The rocky outcrop on the crest of the ridge in the northwest corner of the island has a typical thorn shrub vegetation. This area, which was never under cultivation and has been disturbed only for fuel, is today dominated by an extremely dense growth of *Bauhinia ungula*. These plants, about six feet tall, are well protected with sharp thorns and are extremely attractive when in full white flower. Associated with the *Bauhinia* are *Pithecellobium unguis-cati, Cordia curassavica, Bourreria succulenta, Capparis odoratissima, Erythroxylum ovatum, Casearia decandra* and *Pisonia fragrans*. *Plumeria alba* occurs on projected boulders along with *Tecoma stans*. On the protected lee cliffs, *Pisonia fragrans* and *Bursera Simaruba* have grown into trees. The eastern or windward slope is an open woodland consisting of *Tabebuia pallida, Erithallis fruticosa, Bourreria succulenta, Jacquinia barbasco, Pisonia fragrans, Capparis coccolobifolia* and *Coccoloba caribaea*. This open thornless woodland, in contrast to the spiny crest thickets of *Bauhinia*, is browsed by cattle and goats. Many of the shrubs are overgrown with the rampant climbing *Alternanthera ramosissima* while the herbaceous vine, *Chaetocalyx scandens*, is abundant in open areas. *Justicia periplocifolia, Bernardia corensis*, and *Wedelia Jacquinii* are undershrubs.

The bay at the northern end of the island is a spectacular one with a curving sandy beach ringed by handsome trees of *Hippomane Manchinella*. The coastal area at the northeast corner of the island, however, is all grown up with *Coccoloba uvifera*. These plants were noticed to have a very unusual form, and investigation revealed that for many years they had been cut

back to produce adventitious shoots which were used as wattles for the housing on Mayero. Other stands of sea grape on the southern end of the island all showed the same contorted form due to the same treatment. The mud and wattle houses, thatched with grass or having mud roofs, were the poorest living quarters seen in the Grenadines, the unfortunate result of metayer agriculture on poor land. Along the east coast just back of the *Coccoloba* formation I found numerous plants of *Clerodendrum aculeatum*. This was the only place where I saw this species although Smith reported it from some of the northern Grenadines.

Dr. Nichols reports in his diary of 1891 that "formerly there were a great number of coconuts on the island but they have nearly all died from the blight which also killed out numbers of trees in St. Vincent and other islands of the Grenadines." Only a few coconut palms were seen on Mayero in 1950 (plate 28).

At the southern end of Mayero there is a mangrove swamp separating the main group of hills from a small outlying hill. Two old salt pans exist on the eastern side of this flat land and Dr. Nichols reports in 1890 that these pans were then in use. A small amount of salt is still formed on the edges of these pans and collected for local use.

The Tobago Cays

The Tobago Cays are a group of four islands and one sand bar located about 2 miles east of Mayero and are part of one shallow shelf. For the purposes of description in this paper they are called North Island, West Island, South Island, East Island and Sand Key (plates 4, 21).

The islands are privately owned by the proprietor of Mayero and permission must be obtained to visit them. The islands are uninhabited and lack water. The approach to these islands is made from the southwest through a tortuous channel of only slightly submerged coral reefs. Only the shallowest draft boats can enter this area but once inside the Tobago Cays there is a good, protected anchorage with a sandy botton.

North Island is the largest of the islands and like West, South and East Islands is an elevated coral reef complex. There is a small beach on the southwest corner of the island and a mud flat grown up with *Rhizophora mangle* on the southeast side. The remainder of the shore line consists of wave-cut cliffs or exposed coral formations. The small beach area has an inland fringe of *Coccoloba uvifera* and *Hippomane Manchinella*. The *Rhizophora*

formation slightly to the east is not more than five yards wide and is being cut at present for fuel. Portions of this formation have been completely removed.

The windward slope of North Island is pitted, exposed coral rock. Only *Sesuvium Portulacastrum* and *Cactus Broadwayi* grow on the eastern shore. Immediately behind this zone of spray tolerant plants, however, the brush develops in windrows. That is, a single plant, affected by the prevailing winds and salt spray, will produce branches only to the leeward and grow to considerable length. Definite aisles appear between these wind-affected plants. Plants forming these windrows are *Randia aculeata*, *Tabebuia pallida*, *Pisonia fragrans* and *Pithecellobium unguis-cati*. In the shelter of these plants or in the aisles between them I found *Lantana involucrata*, *Cassia glandulosa* var. *Swartzii* and *Alternanthera ramosissima* in abundance. After these windrow plants reach a height of about six feet, other species grow in their lee. *Jacquinia barbasco*, *Ficus laevigata*, *Cephalocereus nobilis* and *Casearia decandra* develop normally in these areas; however, the most abundant plant in such a location on North Island was *Diospyros inconstans* which was dominant in local areas. *Diospyros* fruits seemed to be the principal food of the iguana (*Iguana iguana iguana*) which was abundant on North Island.

The crest of this ridge was flattened and interrupted by large boulders. The whole was densely overgrown and tremendous specimens of *Cnidoscolus urens* made passage difficult. *Croton flavens* and *Croton astroites*, *Melochia tomentosa*, and *Cordia curassavica* were abundant. In the few open areas there were large seven-foot plants of *Crotalaria lotifolia*. Many of the shrubs in this zone were completely overgrown with the blue-flowered herbaceous vine *Jacquemontia pentantha*.

On the protected lee slope, extending approximately 75 feet above sea level, some larger trees were found. *Bursera Simaruba* was most abundant with occasional specimens of *Cordia collococca*, *Lonchocarpus Benthamianus*, *Capparis odoratissima* and large plants of *Cordia curassavica*. Portions of this slope were solid stands of *Cnidoscolus urens*. The ultimate leeward coast was a coral shelf and the vegetation here was primarily *Alternanthera maritima* and *Sesuvium Portulacastrum*.

The West Island of the group consisted of two hills separated by a sand plain. About two acres of arable land were present in the plain area and in past years, I was told, cotton had been planted here. About a dozen young coconut palms were planted

here in the past few years. The area most recently cultivated has grown up with *Rauwolfia Lamarckii*, *Cnidoscolus urens*, *Melochia tomentosa*, *Wedelia Jacquinii* and *Croton flavens*. Apparently *Panicum maximum* was planted here in the past as this plain is now dominated in local areas by this species. Other grasses encountered in this plain were *Echinochloa colonum* and *Paspalum arundinaceum* both of which formed small grassy savannahs in restricted areas.

The small northern rock outcrop on West Island was dominated by a growth of *Morisonia americana*. This woody member of the *Capparidaceae* formed a plant about six feet tall with long trailing or scrambling branches. The fruits, about the size of a tennis ball, had a foetid odor and were called Jumbie sapodilla. The fishermen who served as my companions on this trip said it was the only plant of its kind in the adjacent islands. Along with the *Morisonia* was a shrub land with *Bourreria succulenta* the most abundant species and lesser amounts of *Capparis odoratissima*, *Tabebuia pallida*, *Jacquinia barbasco* and woody specimens of *Cassia glandulosa* var. *Swartzii* which often reached six feet in height. Undergrowth in this area consisted of *Cephalocereus nobilis*, *Opuntia Dillenii*, *Cactus Broadwayi*, *Aechmea lingulata* and *Agave caribaeicola*.

The southern hill of West Island is approximately 150 feet high and the highest point in the Tobago Cays. This ridge is heavily wooded with *Capparis odoratissima*, *Capparis coccolobifolia*, *Coccoloba caribaea*, *Randia aculeata*, and *Bourreria succulenta*. This area is heavily infested with *Caesalpinia Bonduc*, *Tragia volubilis* and *Cnidoscolus urens* making penetration difficult.

The East Island has a gradual slope from an extensive sandy beach on the south to a rocky outcrop perhaps 50 feet tall on the north. The beach vegetation consists of a heavy growth of *Coccoloba uvifera* and *Hippomane Manchinella* with a coastal fringe of *Tournefortia gnaphalodes*. *Caesalpinia Bonduc* is present and climbing over the *Tournefortia* shrub area. The rocky outcrop appears to have been cleared at some time in the past. The most conspicuous plant of this area is a large leafed *Agave* which may be *Agave sisal*. The stout spines and the dense growth of this plant make penetration of this small island difficult. *Acacia macracanthoides* is the most abundant shrub in the center of the island but the margins have the unusual association of *Capparis odoratissima*, *Bourreria succulenta* and *Maytenus elliptica*.

South Island is the smallest of the four comprising the Tobago Cays. A coral sand beach has been deposited on the eastern side of the island and *Hippomane* is well established on this beach and slightly encroaching on the rocky ridge. The ridge has an open woody vegetation consisting of *Bourreria succulenta, Ficus laevigata, Pisonia fragrans, Jacquinia barbasco* and several species of *Croton*. This area too is well protected by the dense undershrub of *Cnidoscolus urens*.

Sand Cay is a deposit of coral sand in the midst of a complex of submerged coral reefs. The tides made it impossible to land on this island, but from the sea the plants visible were a single coconut palm and a beach association of *Coccoloba* and *Hippomane*. The size of this island varies with the season of the year, sand being deposited at certain periods and eroded away during others. In late March 1950 the island was reported at its highest stage of development and was about ten feet above sea level and about 200 yards long.

Cannouan Island

The shape of Cannouan Island has been compared with that of a sea horse (plate 4). The island is approximately 3.5 miles long and 1.5 miles wide at its greatest dimensions. One ridge runs the length of the island and another extends across the northern end. Mt. Royal in the northeast corner of the island is 837 feet high, the highest point on the island (plate 20).

Charlestown Bay on the west coast of Cannouan is a large, deep and open bay offering little protection for small boats at anchor. This bay, however, is the landing point for the island. Maho Bay on the north coast is smaller and more protected but it cannot be approached from the land. A small circular bay on the east coast at the southern foot of Mt. Royal can be entered only by shallow draft boats as the entire east coast is protected by a fringe of reefs with a narrow entrance at the extreme southern end. The remainder of the coast line consists of wave-cut cliffs.

Cannouan has been heavily cultivated in the past but the lack of rainfall, erosion of the land and general exhaustion of the soil have reduced the acreage under cultivation in recent years. This abandonment has been going on gradually and the changes in the vegetation on fields abandoned for different lengths of time is quite well marked and will be described in subsequent paragraphs.

At the present time most of the agriculture is carried on at the southern end of the island with a small acreage under cultivation

around Maho Bay. The principal crops are cotton, pigeon peas and sweet potatoes. Sea island cotton is grown and the destruction of the plants in the spring is closely controlled by the agricultural station on the island with the result that erosion and run off are severe. To counteract this erosion an attempt is being made to terrace the land and construct drainage ditches and canals in the south part of the island.

An old estate on the eastern coast of Cannouan has been purchased by the St. Vincent government and developed as a demonstration area for the Department of Agriculture. The land had not been in use for forty years and it was necessary to reclaim this for cultivation. The plot selected is a natural bowl and all the land under cultivation is sloping. The soil which has accumulated by run off from higher elevations is dry but good, fairly rock free and deep. The original crop for experiment was cotton but the program in recent years has been diversified to include corn, root crops and sugar cane. The land has been slightly terraced by the use of Khus-Khus grass (*Vetiveria zizanioides*) as contour markers and erosion control. The Elephant Grass (*Pennisetum purpureum*) has recently been introduced as a soil cover and source of forage for breeding stock. Cotton has proven to be a productive crop in this area when the soil was fortified with fertilizer but the station is handicapped by the shortage of labor for picking the crop. It is hoped that the agricultural methods demonstrated at the station will be adopted by the local farmers.

The only area of Cannouan that has never been under cultivation is in the northeast corner of the island and comprises the slopes of Mt. Royal. In recent years this area has been designated as a forest reserve and is guarded. Before this, however, some wood was cut from the area and only the most inaccessible spots can be regarded as relatively undisturbed.

John Beard studied, by transect method, two slopes of Mt. Royal. One transect was made on the lee slope, the northwest corner, of Mt. Royal just below the summit at the "8–900" foot elevation. Beard reports (Oxford For. Mem. **21**: 145–6. 1949) "the woodland here contains the only large trees on the island, up to 50′ tall and 4′ in girth, but badly formed, branchy, crooked, and smothered with vines. No definite canopy is formed. The poor structure is probably due to interference in the past, only the inaccessibility of the spot having saved the forest from complete destruction."

Beard then cites the following species as dominants, in order of their frequency of occurrence, in this woodland: *Bursera Sima-*

ruba, Hymenaea Courbaril, Pisonia fragrans, Tabebuia pallida, Ficus lentiginosa, Spondias Mombin, Bourreria succulenta. Smaller trees present, also listed in their order of frequency were: *Guettarda scabra, Guettarda parviflora, Maytenus elliptica, Nectandra coriacea, Inga laurina, Citharexylum spinosum, Dipholis salicifolia, Genipa americana, Coccoloba venosa, Phyllanthus antillanus.* Beard also concludes "The dense shrubby understory contains mainly *C. venosa, Nectandra coriacea, Guettarda parviflora* with some *Dipholis, Maytenus* and *Bunchosia* and a smaller plant *Odontonema.* There is practically no ground cover vegetation. Epiphytes are rare but vines extremely abundant."

I have not seen Beard's specimens of *Coccoloba venosa* but as I searched the same area myself I believe he mistook *Coccoloba caribaea* in its adventitious shoot form for *C. venosa.*

Beard also made a transect on the southeastern side of Mt. Royal (plate 20), the opposite side from the *Bursera-Hymenaea* woodland just described. He describes this as a bushland with a vegetation twelve to twenty feet tall, very dense, composed of crowded small gnarled trees. He lists the principal species of *Tabebuia pallida, Guettarda scabra, Maytenus elliptica, Pisonia fragrans, Comocladia Dodonaea, Jacquinia barbasco, Bursera Simaruba, Erithallis fruticosa, Plumeria alba, Randia mitis,* two spp. of *Eugenia,* two spp. of *Croton;* more rarely *Lonchocarpus Benthamianus, Guettarda parviflora, Genipa americana, Pithecellobium unguis-cati,* and *Amyris elemifera.* Beard continues "A small sedge, *Scleria lithosperma,* is common on the ground and there are two species of orchids and two of bromeliads all of which may be either epiphytic or terrestrial, and are abundant in both cases. The parasite, *Phoradendron trinervium,* is rather common on *Pisonia* trees and an occasional *Agave* is conspicuous among the ground plants. The whole flora is poor and contains elements of evergreen highland. *Tabebuia* is much the most common species and its dominance together with the presence of *Comocladia* is particularly suggestive. Nearing the sea the bush becomes low and windbent with *Tabebuia, Pisonia* and *Jacquinia* as the principal species. The littoral margin is marked by the appearance of *Conocarpus erectus* and occasional open grassy patches are dotted with *Cactus Broadwayi.*"

I approached Mt. Royal from the southwest starting at the agricultural station and climbing to the rock pile that is the summit of the mountain. The lower elevations are now planted to cotton but immediately above this present area of cultivation are old fields. The limits of former cultivation were clearly

delimited by the types of vegetation now growing there. It is obvious that the upper fields were abandoned first and the lower fields more recently. Directly above a coastal field now planted to cotton are old cultivated fields grown back into low brush land of *Croton flavens*, *Melochia nodiflora* and *Melochia tomentosa*. This was a well marked zone and directly above this area on the slope the next fields were grown up in a twelve foot bush composed of *Leucaena glauca*, *Acacia macracanthoides*, and *Acacia nilotica*. A third line of cultivation above these fields and still older in terms of years since abandonment showed some of these same plants but ever increasing numbers of *Capparis coccolobifolia*, *Bauhinia ungula*, *Bourreria succulenta* and *Citharexylum spinosum*. It is clear in this area that as fields are abandoned they grow up in pure or almost pure stands of low shrubs, generally *Croton flavens* and species of *Melochia*. These fields are invaded and replaced by *Leucaena* and *Acacia* in Cannouan and this growth is in turn invaded and ultimately crowded out by *Bauhinia*, *Bourreria* and *Citharexylum*. Ultimately a mixed dry woodland is produced by further invasion giving the mixture described by Beard.

On the ascent of Mt. Royal from the southwest the upper limit of these old fields is clearly marked by a change in vegetation from the dense crowded brush land just described to an open sunny evergreen woodland with only a few deciduous species. Such limits are usually at changes in the substratum from a deep soil to areas where the rock base is exposed and the soil thinner. It is this area that is the forest reserve today although cutting goes on at the present time and the few potentially useful timber trees are being removed while still of small size. The open sunny woodland on the shoulder of Mt. Royal compares with that described by Beard for the northeast or lee slope. On the southwest corner I would call the vegetation a *Hymenaea-Coccoloba* formation rather than *Bursera-Hymenaea*. *Bursera* appears to me to be a weedy tree of the area occurring as an invader of disturbed woodland. The natural components of this woodland appear to be dominated by *Hymenaea Courbaril* and *Coccoloba caribaea*. Certainly the largest trees seen on the southwest slope of Mt. Royal were specimens of *Coccoloba caribaea*. This species is well marked by a sinuous-muscular trunk. It stands out in contrast to the sculptured trunks of *Guettarda scabra* and the red peeling trunks of *Bursera Simaruba*.

Mixed in this open woodland dominated by *Hymenaea* and *Coccoloba caribaea* are the following species listed in order of

abundance as I saw them: *Lonchocarpus Benthamianus*, *Guettarda scabra*, *Tabebuia pallida*, *Maytenus elliptica*, *Pisonia fragrans*, *Bursera Simaruba*, *Pithecellobium unguis-cati*, and *Genipa americana*. *Eugenia ligustrina* is abundant in restricted areas and *Bourreria succulenta*, *Guettarda parviflora*, *Pedilanthus tithymaloides*, *Croton populifolius*, *Lantana reticulata*, and *Ficus laevigata* occur occasionally. *Scleria lithosperma* is abundant as a clump sedge in this open woodland and such woody herbs or low plants as *Sida glomerata*, *Cassia glandulosa* var. *Swartzii*, *Acalypha cuspidata*, *Wedelia Jacquinii* and *Enicostema verticillatum* are abundant. *Passiflora foetida* var. *hispida* is the most common herbaceous vine while *Tournefortia volubilis*, *Doxantha unguis-cati*, *Psychotria microdon*, and *Heteropteris purpurea* are abundant woody vines or scrambling plants.

A rock formation extends perhaps one hundred feet above the sloping shoulder of Mt. Royal and the same dry open woodland exists on these rocks. However, the more conspicuous elements on this area are the rock dwelling plants which cover large areas and make climbing difficult. *Cnidoscolus urens*, the devil nettle, *Comocladia Dodonaea*, *Agave* sp., *Plumeria alba* are the largest of these plants while smaller but locally more abundant plants include *Aechmea lingulata*, *Cenchrus echinatus*, *Portulaca oleracea*, *Pilea microphylla*, *Epidendrum ciliare*. The vine *Ceratosanthes palmata* was abundant on this rock outcrop.

The northern half of the western side of the island of Cannouan and most of the northwestern corner of the island has all been under cultivation at one time or another. Several plots of brush land, formerly cultivated, were being reclaimed for cultivation in 1950. Many of the old fields were well marked by a change in the dominant plant in the vegetation, others by rock fences and others by trails distinguishable yet now growing up in brush. Old fields had grown up in pure or occasionally mixed stands of *Leucaena glauca*, *Bourreria succulenta*, *Bauhinia ungula*, *Cordia curassavica*, *Cordia globosa* or *Croton flavens*. Numerous evidences of former cultivation were evident in such scattered trees as *Ceiba pentandra*, *Tamarindus indica*, *Crescentia Cujete*, *Spondias Mombin*, *Sapindus saponaria*, several species of *Annona* and even *Mangifera indica*. At present these trees are isolated in shrub growth but near them one finds ruins of old stone houses or even catchment areas for collection of rainfall.

On the northwest corner of the island the soil is shallow or in pockets of a rock outcrop. Large boulders and masses of rocks are perched on the point. The vegetation here is similar in

aspect and basic composition to the *Hymenaea-Coccoloba caribaea* formation on Mt. Royal but is obviously secondary in nature. Stumps of trees are found in all stages of decay indicating this area served as the fuel supply for the former inhabitants of this western coast. Associated with the plants of *Hymenaea* and *Coccoloba caribaea* are *Pisonia fragrans, Genipa americana, Erythroxylum ovatum, Amyris elemifera, Citharexylum spinosum, Randia aculeata, Capparis odoratissima, Capparis coccolobifolia, Schaefferia frutescens, Bunchosia nitida, Maytenus elliptica,* and *Rauwolfia Lamarckii.*

Cephalocereus nobilis, Aechmea lingulata and *Epidendrum ciliare* were abundant on rocks, and epiphytes included *Tillandsia utriculata, T. flexuosa,* and *Brassavola cucullata.*

Climbing plants included *Commelina elegans* with stems seven feet long, *Lasiacis divaricata, Cissus sicyoides, Corallocarpus emetocatharticus* and *Psychotria microdon. Alternanthera ramossisima* was very abundant in open areas.

The southern half of the island was heavily cultivated to cotton and pigeon peas on the leeward slopes and the windward slopes were generally used as pastures. Many of the windward slopes were grassy plains and in these areas the Department of Agriculture is attempting a program of reforestation. Portions of this coast showed the typical windswept vegetation described by Beard for the windward coast of Mt. Royal. Along the seacoast or where the plants are subject to salt water spray *Pectis, Evolulus, Euphorbia serpens, Desmanthus depressus, Boerhaavia erecta* and *Cactus Broadwayi* dominate the rock exposures. Further inland a shrub association of contorted windswept plants of *Tabebuia pallida, Randia aculeata* and *Pithecellobium unguis-cati* is present. In protected spots near the ridge there were numerous but scattered specimens of *Schoepfia Schreberi,* some of these trees reaching a height of eighteen feet.

Bequia

The northernmost island of the Grenadines is the island of Bequia located about nine miles south of St. Vincent. Bequia has always been heavily populated and cultivated and the vegetation, therefore, is much altered with secondary brush land predominating. The only untouched woodland seems to be on the cliff faces of the northeastern portion of the island. The rainfall of Bequia is higher than that of other islands of the Grenadines possibly because of its proximity to the island of St. Vincent. There are in the vegetation several elements of a

wetter flora and I suspect that the vegetation of Bequia in undisturbed condition would be approximately that of the southern slopes of St. Vincent.

Bequia is about seven miles long and two miles wide. On the eastern side is a large broad and deep harbour called Admiralty Bay which serves as anchorage and shelter for much of the fishing fleet of the Grenadine-St. Vincent waters. The whaling industry of the Grenadines is also centered on Bequia with most of these smaller boats basing on the south coast. Boat building and repair has always been an industry of the island and for that reason the principal wood, *Tabebuia pallida*, is rare and is found only as small sized plants on the island.

Shephard (1831) reported that 3700 acres of land on Bequia, comprising nine estates, were planted in sugar cane. The production for the years 1827–29 averaged 183 tons of sugar, 15,500 gallons of rum and 21,045 gallons of molasses. Ober (1879) does not comment on the agriculture of the area but did state "wood is plentiful and may be obtained by permission from the owners, but it is doubtful if the natives would cut it. Poultry may be had in small quantities and sometimes fish but vegetables never." Dr. Nichols reported in his diary in 1891 "that in the former days before the sugar crisis a good deal of sugar was exported and ruins of old sugar works are seen in various places. A little sugar is still grown. In the interior is the ruins of an old and substantial sugar factory which used cattle power to grind the cane." In 1912 an attempt was made to grow arrowroot on Bequia but this agriculture did not persist. In 1930 sea island cotton was introduced to Bequia and that crop forms the principal agriculture of the island today. A plantation of coconuts exists in the northeast corner of the island and a few small fields of sugar cane are found to produce the locally used crude sugar. Pigeon peas mixed with cassava are grown for local consumption. A large number of *Anacardium*, *Achras*, *Mangifera*, *Annona* trees are found near present habitations and occurring sporadically in areas of brush which were formerly cultivated.

In his diary Dr. Nichols gave a list of "the most conspicuous plants, illustrative of the vegetation of the island" in 1891. I have placed in parentheses the current names for these plants. 1. Turpentine tree called gommies (*Bursera Simaruba*) 2. Silk cotton (*Ceiba pentandra*) 3. Tamarind (*Tamarindus indica*) 4. Coconut (*Cocos nucifera*) 5. Cedar, two kinds, simple and compound leaves (*Tabebuia pallida*, simple and multifoliate forms) 6. White plumeria (*Plumeria alba*) 7. *Erythroxylon* (*Erythroxylum*

ovatum) 8. *Capparis amygdalina* (*Capparis indica*) 9. *Capparis cynophyllophora* (*Capparis coccolobifolia*) 10. *Calliandra purpurea* 11. A four-gonal creeping Cereus (*Hylocereus trigonus*) 12. *Opuntia* (*Opuntia Dillenii*) 13. An ivy like plant 14. Manjack, *Cordia* (*Cordia obliqua*) 15. Mistletoe, *Loranthus* (*Phoradendron trinervium*) 16. Black sage (*Cordia curassavica*) 17. *Lantana*, used as an emetic (*Lantana reticulata*) 18. Manchioneel (*Hippomane Manchinella*) 19. Tillandsias (*Tillandsia fasciculata, flexuosa, utriculata*) 20. *Agave rigida* 21. *Urena lobata* 22. *Calotropis* (*Calotropis procera*) 23. *Solanum aculeatum* (*Solanum lancifolium*). Of this list the "ivy like plant" cannot be identified with certainty. *Agave rigida* is doubtful and while several Agaves were seen none were in flowering condition. *Urena lobata* has not been reported from Bequia by Smith and I saw no material of this genus from the Grenadines.

On old cultivated fields throughout Bequia at the present time one finds pure stands of *Randia aculeata, Croton niveus, Croton flavens, Leucaena glauca,* and *Guettarda scabra.* Other fields will be mixtures of these species alone or in combination with *Pimenta racemosa, Bourreria succulenta, Haematoxylon campechianum, Tabebuia pallida, Genipa americana, Eugenia cordata* var. *Sintenisii, Calliandra purpurea, Acacia tamarindifolia, Citharexylum spinosum, Comocladia Dodonaea. Waltheria americana, Wedelia Jacquinii* and *Lantana reticulata* were abundant as lower plants.

The old fields which have grown up in *Guettarda scabra* are considered valuable lands as sources of poles for general construction. Several fields were being weeded of other plants in the spring of 1950 in order to encourage suckering of *Guettarda scabra.* The young plants of this species form straight slender trunks which in many fields averaged ten feet long and two inches in diameter. The wood is hard, somewhat resistant to termites and used generally in all types of rough construction, such as roof poles, siding for houses of mud and wattle and even flooring.

The north coast of the southwest peninsula has been cultivated in the past especially near Port Elizabeth. A good trail runs along the coast ending in the last cultivated field about one-third the way along the peninsula. Beyond that point the slopes are relatively undisturbed. Some grazing, particularly by goats, has taken place recently and near the ridge some cutting of wood for fuel was evident. The hillslopes here have a mixed vegetation of the dry open woodland type. Only a few large trees were seen and most of the plants were about twenty feet tall. This wood-

land was composed of the following dominant woody species: *Linociera caribaea, Bumelia obovata, Coccoloba caribaea, Miconia laevigata, Psychotria Berteriana,* and *Pisonia fragrans.* Less abundant were *Lonchocarpus Benthamianus, Bursera Simaruba, Ceiba pentandra, Exostema caribaeum, Erithallis fruticosa, Schoepfia Schreberi, Krugiodendron ferreum, Cornutia pyramidalis, Bunchosia nitida, Guettarda scabra, Guettarda parviflora, Maytenus elliptica. Cordia curassavica, Pedilanthus tithymaloides, Euphorbia cotinifolia* and *Bernardia dichotoma* formed a shrubby undergrowth. Clumps of *Scleria lithosperma* were common while on rocks, particularly in the eroded valleys, *Aechmea lingulata, Callisia repens, Epidendrum ciliare, Peperomia Rupertiana, Peperomia Sintenisii,* and *Pitcairnia latifolia* were abundant locally. *Clusia minor,* a weak climbing tree, was represented by one mature tree and numerous very young plants starting as epiphytes. Without doubt this plant will be more abundant in a few years.

The crest of the ridge of the southern peninsula had an open, spiny shrub vegetation and the area was immediately conspicuous because of the thorny elements and the abundance of herbs, epiphytes and vines.

The components of the thorn shrub vegetation on the ridge were *Bauhinia ungula, Pithecellobium unguis-cati,* and *Opuntia Dillenii* along with *Comocladia Dodonaea, Erithallis fruticosa, Amyris elemifera, Tabebuia pallida, Plumeria alba,* and *Maytenus elliptica,* and the prostrate *Malpighia coccigera* which covered large areas. *Heliotropium ternatum* was abundant in many of the clumps of *Opuntia* and *Oxalis fruticosa* with some plants two feet tall was a common herb of the shrub land. *Enicostema verticillatum* and *Trimezia martinicensis* were also abundant herbaceous plants. The shrubs here were heavilyl oaded with *Tillandsia fasciculata, Tillandsia utriculata, Brassavola cucullata* and *Catopsis floribunda. Passiflora suberosa* and *Corallocarpus emetocatharticus* were abundant herbaceous vines while *Pisonia aculeata* formed a tangle in many areas.

The coast line on the southern peninsula was all wave-cut with rocky beaches or with coral shelves extending out in the ocean. Back of the cliffs the usual succulent prostrate vegetation served as a browsing area for many goats.

The northwest peninsula is known locally as Cinnamon Ridge or Cinnamon Gardens. While much of this area is cultivated, other portions, previously cultivated, have now grown back in brush. However, scattered through these old fields are many

plants of *Pimenta racemosa* called "cinnamon" locally and source of the place name. The local inhabitants claimed the plant to be true cinnamon and that it had been introduced as such from the botanical garden in St. Vincent. They claimed that for a few years bark had been collected from the trees but there was no market for it and the project was abandoned. *Pimenta racemosa* has an aromatic principle in the bark and leaves and the confusion is understandable. In recent years the trees have flowered and set fruit and young plants were widely distributed. The largest trees seen, however, were forty feet tall with a trunk diameter of eighteen inches at breast height. Along with *Bursera* these trees were the largest ones in this area.

The undisturbed woodland on the northern slopes or cliffs of this peninsula were open and consisted of twenty-five to forty foot trees with straight trunks. *Linociera caribaea, Nectandra coriacea, Miconia laevigata, Schoepfia Schreberi, Psychotria Berteriana* were abundant. Undershrubs on this hillside were dominated by large woody specimens of *Cnidoscolus urens* some of which were eight feet tall. *Pisonia fragrans, Maytenus elliptica, Eugenia ligustrina, Jacquinia revoluta, Euphorbia articulata, Piper dilatatum* also were found in the shrub layer. Several of the valleys on the north slope of this peninsula contained deep dark soil with a good humus layer. In such areas *Oplismenus hirtellus, Adiantum villosum, Peperomia magnoliaefolia* and *Andropogon condensatus* were found. *Gouania lupuloides* and *Securidaca Lamarckii* were the most conspicuous woody vines while the herbaceous vine *Cynanchum parviflorum* and the climbing grass *Lasiacis divaricata* were of limited occurrence.

At the extreme end of the northeast peninsula the soil layer becomes thin and on the summits of the ridge at various places the soil has been completely removed and bare rock or boulders remain. This open woodland possessed *Epidendrum ciliare* and *Brassavola cucullata* which are widely distributed epiphytes in the Grenadines. In addition the ferns, *Phlebodium aureum, Paltonium lanceolatum* and *Cheilanthes microphylla,* were found growing on trees or on the rocks. The latter two species were seen only on Bequia. *Oncidium cebolleta* was abundant on a few trees and about six specimens of *Oncidium luridum* with inflorescence to six feet in length were found. These two species were found only on Bequia. *Hylocereus trigonus* grew in profusion in open areas, especially near the end of the northeast peninsula where the dominant vegetation consisted of *Randia, Tabebuia, Jacquinia barbasco, Bourreria* and *Plumeria.* Many

of these plants were windswept or killed back by the effects of the salt spray.

Mustique

The island of Mustique, originally called Moustiques, is located about 10 miles southeast of Bequia (plates 6, 27). It is a small island, approximately 2.5 miles long and 1 mile wide. The highest point on the island is 475 feet but the relief consists of a series of small isolated hills with considerable flat agricultural land. All past reports on Mustique have referred to the fertile soil, good crops, excellent pasture and healthful climate.

Mustique was one of the last islands of the Grenadines to abandon sugar cane as the principal crop. In 1827–29 an average of 888 acres were under cultivation in cane. The production during these years averaged 53 long tons of sugar, 2633 gallons of rum and 4333 gallons of molasses per year. By 1841 Bequia and Mustique were the only two islands of this group still producing sugar and the island of Mustique in that period was divided between two proprietors growing cane. By 1891 Mustique had abandoned cane and was in the hands of a single owner whose family owns the island at present. Dr. Nichols visited Mustique in 1891 and reports in his diary "we visited the old sugar works and saw the remains of a cotton gin. In the olden days sugar was cultivated and the island was divided into two estates. Later on when the Hazells got there the island was planted to cotton but now the only cultivation seen is the few gardens where vegetables are raised for the needs of the small population. The whole island is now a stock farm, cattle, sheep and horses being bred for exportation. The great defect now is the water supply which in dry weather almost ceases. Shallow wells have been dug and there are ponds in several places."

Dr. Nichols also describes the vegetation following a trip around the island on horseback. "We came back another way and saw young sisal plants that have been planted a short time ago. The ground was covered principally with the savannah grass, *Paspalum distichum*, and *Acacia Farnesiana* and white cedars were fairly abundant. The purple bell-shaped flowers of *Ruellia tuberosa* were frequently seen. Close by a pond on the flat below the house is a fine large Baobab, *Adansonia digitata*, growing luxuriantly and it must have been brought to the island many years ago. *Bignonia unguis* was plentiful running up the hillsides over the shrub. An *Erythroxylum* and a low small-leaved *Croton* were plentiful. We passed the ruins of an old

house and sugar works at the end of the valley where it opens up into a small plain and above the crumbling walls and rain cistern was a hill on the top of which was an old fort we visited, not, however, without being well pricked by the spines of a cactus. *Opuntia java* grew here in profusion. We threw rocks at the turks head cacti, *Melocactus communis*, at the south end of the island which were perched about in all directions on the rocky ledges and on the sloping ground. In one or two the woolly crowns were double."

Mustique today has a population of about 400 people with their houses mostly in the northwest corner of the island. A little sea island cotton is grown for export and some sugar cane purely for local use. The industry today as in 1891, at the time of Dr. Nichols' visit, is the raising of stock. The land is well suited for horses and excellent animals are raised. A strain of brahma cattle has been introduced and reproduces well. Sheep and goats are allowed to roam loose on the island but these animals become so wild they must be shot rather than herded and so are used or exported as meat.

The cotton grown on Mustique is centered in the Grand Bay valley near the southern end of the island, and the remainder of the island has been allowed to grow up undisturbed for over sixty years. It is interesting to note that in that time no large trees have developed and the extensive wooded areas consist of a dense growth of shrubs and small trees not more than twenty-five feet tall with most brush lands averaging fifteen feet in height (plate 27). The plants are contorted, branchy and there is little ground cover under them. The brush land is primarily an association of *Haematoxylon*, *Bourreria*, *Coccoloba caribaea*, and *Guettarda parviflora*. The following species occur in association the abundance of each varying considerably from one area to another or from one hilltop to another: *Pithecellobium unguiscati*, *Acacia nilotica*, *Tamarindus indica*, *Citharexylum spinosum*, *Forestiera rhamnifolia*, *Bursera Simaruba*, *Leucaena glauca*, *Calliandra purpurea*, *Comocladia Dodonaea*, *Capparis coccolobifolia*, *Pisonia fragrans*, *Tabebuia pallida*, *Jacquinia barbasco*, *Lonchocarpus Benthamianus*, *Schoepfia Schreberi*, *Piscidia piscipula*, *Tecoma stans* and *Erythroxylum ovatum* and *Eugenia ligustrina*. The whole area is often dominated by woody or herbaceous vines with *Pisonia aculeata*, *Gouania lupuloides*, *Matelea maritima*, *Jacquemontia pentantha*, and *Corallocarpus emetocatharticus* and *Passiflora foetida* abundant locally.

Some of the more recently abandoned cotton fields have grown up in a brush land consisting of *Randia aculeata*, *Melochia tomen-*

tosa, *Cordia curassavica*, *Acacia nilotica*, *Croton flavens* and *Croton niveus*. Rocky outcrops support large growths of *Hylocereus trigonus* and *Epidendrum ciliare*. *Tillandsia utriculata* is a common epiphyte but the majority of these plants seen on Mustique have aberrant inflorescences apparently due to damage by salt spray from the prevailing winds.

Many parts of the windward coast show the typical windblown formations of contorted plants of *Randia aculeata* and *Tabebuia pallida*. In the northeast corner there is an open park-like association of *Hippomane Manchinella* growing on coral rock. The trees are widely spaced, about twenty-five feet tall and the ground is covered with many years accumulation of dried leaves. Extensive grassy savannah areas also occur on the windward coast and serve as pasture lands. These may be dotted by scattered windblown specimens of *Jacquinia barbasco*, *Tabebuia pallida*, *Pisonia fragrans* or *Guettarda scabra*.

An extensive development of *Avicennia nitida* bordered on the coastal side by *Rhizophora mangle* is found at Grand Bay, especially around the salt pond there. Protected coves elsewhere on the island will also have *Rhizophora* present but most of the exposed coastal areas have an association of *Hippomane*, *Tabebuia* or *Plumeria* growing on the rocks.

The pond in the northwest corner of the island is a water catchment area for stock but during the first part of April 1950 this pond was nearly dry and the entire area had grown up in an accumulation of weeds: *Calotropis*, *Scoparia*, *Melochia tomentosa*, *Malachra alceifolia* and a variety of grasses and sedges.

The *Adansonia* which Dr. Nichols reported in 1891 is still alive growing on the flat land just below the great house.

Balliceaux

The island of Balliceaux is located about 10 miles southeast of Bequia and 3 miles north northeast of Mustique. This island is about 1.5 miles long and 1 mile wide with the highest point reaching 430 feet above sea level (plate 6). The feature of the island, geologically, is the extensive deposits of kaolin and recent guano. The kaolin strata are conspicuously exposed along the wave-cut northwest corner of this island and crop out elsewhere on the island. They are vivid in color, covering most of the colors of the rainbow. The deposits have been investigated commercially in the past but are extremely heterogeneous and of little commercial value. The guano is recent and is accumulating at the present due to the large number of sea birds that nest on

the flat shrub growth of *Randia aculeata* on the island. The name of the island itself is a corruption of Belles oiseaux.

The coast line is wave cut with the exception of one or two small areas where shallow coral shelves extend outward from the coast. Little sandy beach was found and piles of rounded boulders mark the high tide limit. Only the smallest boats are beached on Balliceaux.

Shephard reports that in 1831 the island was used as a stock island and Ober (1879) mentions the cattle and sheep that are raised there. Trendell in 1886 reported that deer and rabbits abounded on the island. However, sometime in the past sugar cane was grown on Balliceaux for an old windmill tower of the type used to grind cane and several boiling houses for the evaporation of syrup could be recognized among the stone ruins on the island. A large house once existed on Balliceaux indicating the land was profitably employed in agriculture. In recent years Balliceaux has been used for raising stock and for growing cotton. Unfortunately cattle will not reproduce any more on Balliceaux and stock placed there wither away without any increase in numbers. This is not true of burros, however, and a few of these animals introduced in recent years have multiplied and roam the island quite wild. Their browsing has a noticeable effect on the vegetation.

The lands planted to cotton in 1950 were in the northern half of Balliceaux. The southern end of the island had a shallow soil, badly eroded, with masses of rock and boulders exposed everywhere. The vegetation here was poor, low, windswept and uninspiring (plates 16, 17). Both coasts seem to be affected by spray of salt water and the coastal rocks on the leeward side and the lower half of the windward slopes are covered with a low succulent vegetation of *Dactyloctenium*, *Pectis*, *Euphorbia*, *Trianthema* and *Lithophila* with all the plants prostrate and creeping. Only *Cactus Broadwayi* protrudes in these areas. The upper half of the windward slopes is dominated by extensive growths of *Randia aculeata*. Here the plants also grow in windrows with a single plant, growing with the prevailing wind, extending several yards by the development of the lateral leeward branches (plate 17). In the lee of these foremost plants other plants take shelter and develop more erect; however, some of the windrows start near the crest and become branched only at the crest as they extend over the lee slope. Few of these contorted plants exceed four feet in height. Wide aisles are sometimes present between these wind created rows of shrub growth. On the lee slopes the

plants have branches developed normally on all sides but even here the plants are truncated at the top with characteristically spreading wide lower branches (plate 16). Most of these plants are of greater diameter than height. A few plants of *Croton flavens* are found here and in small valleys on the lee slopes *Acacia nilotica* and *Cassia bicapsularis* are found.

The center of the island has a shrub growth four to seven feet high consisting primarily of *Randia* with occasional specimens of *Bourreria, Croton flavens* and *Hippomane. Acacia nilotica* is present in local areas of dominance which I suspect were areas once cultivated. The only tall plants in this area are very occasional small trees of *Capparis odoratissima, Capparis coccolobifolia, Pisonia fragrans* and *Tabebuia pallida,* the tallest of which is twelve feet tall. A small pond on the summit of the ridge serves as a water catchment area for the burros and the surface of this was covered with *Lemna perpusilla.*

The northern portion of the island is now being cultivated in cotton, particularly on the windward coast. All brush has been removed and erosion goes on unchecked. A few patches of undisturbed brush land at the northern end are dominated by *Randia* with only occasional specimens of *Acacia nilotica, Bourreria succulenta* and *Croton flavens.*

A small cove at the center of the west coast of the island has a grove of *Hippomane* and *Tabebuia pallida.* Both of these plants are cut for firewood.

The agriculture on Balliceaux is definitely marginal and I was told the island is used only as a source of "poles." It is hard to imagine what plant on this island would supply these "poles."

Battowia

Battowia is perhaps the best known island of the Grenadines. This tiny island with dimensions of a little over one-half a mile was the spot to which the Caribs were exiled from St. Vincent in 1797 prior to their removal to Honduras. Figures vary but it is estimated that 3000 Indians were forced to exist on this tiny bit of land within sight of St. Vincent and the green hills of Bequia. The highest point on Battowia is 680 feet above sea level and is in the northeast corner. The land slopes in an amphitheatre formation to a small cove on the south at the western corner. Sometime in the past sugar cane was grown on this island for a boiling house with its kettles still remains. A few coconut trees were seen and the inhabitants of Balliceaux report they were more abundant a few years ago. At the present time some

cotton is grown on Battowia and the native grasses are cut for forage for the animals on Balliceaux.

Brush land rings the central valley of Battowia and occurs also on the slopes cliffs around the island. *Hippomane*, *Tabebuia*, *Acacia nilotica* and *Bourreria* occur in that order of frequency.

PART III. SYSTEMATIC TREATMENT OF THE FLORA

TABLE OF SPECIES AND DISTRIBUTION

FILICINEAE

ADIANTUM VILLOSUM L. Bequia, *Howard 11265.*

A terrestrial fern found only on hillslopes in wooded valleys on the northeast peninsula of Bequia. The fronds were three feet tall.

CHEILANTHES MICROPHYLLA Sw. Bequia, *Howard 11263.*

A rare fern on rocky outcrops of the north coast of Bequia.

DRYOPTERIS CONCOLOR (L.) Kuhn. Union, *Howard 11006.*

A plant of rock cliff faces in the Chattam Bay area of Union.

PALTONIUM LANCEOLATUM (L.) Presl. Bequia, *Howard 11284.*

PHLEBODIUM AUREUM (L.) J. Smith. Isle of Ronde, *Howard 10778;* Union, *Howard 11011;* Bequia, *Howard 11280.*

An epiphytic plant found more commonly growing on open rocks near the summits of ridges.

POLYPODIUM POLYPODIOIDES (L.) Watts. Union, *Howard 10979.*

This plant was found only on the rocks at the ultimate summit of the Pinnacle.

POTAMOGETONACEAE

DIPLANTHERA WRIGHTII Aschers. Union, *Howard 10999.*

RUPPIA MARITIMA L. Carriacou, *Howard 10948.*

Marine plant on the ocean side of mangrove swamps.

HYDROCHARITACEAE

THALASSIA TESTUDINUM König & Sims.

Marine plant forming extensive beds in shallow waters north of Prune Island (plate 8).

GRAMINEAE

ANDROPOGON CARICOSUS L. Bequia, *Howard 11272.*

Open areas near currently cultivated fields on the north ridge.

ANDROPOGON CONDENSATUS HBK. Bequia, *Howard 11273.*

Grass of rocks on the extreme eastern point of the north ridge. Foliage conspicuously dark green and red.

ANDROPOGON SACCHAROIDES Sw. Bequia, *Smiths 18, 24!;* Mustique, *Smiths 65.*

ANTHEPHORA HERMAPHRODITA (L.) Ktze. *Anthephora elegans* sensu Smith. Bequia, *Smiths 344!;* Mustique, *Smiths 61;* Union, *Smiths 49.*

AXONOPUS COMPRESSUS (Sw.) Beauv. *Paspalum compressum* sensu Smith. Bequia, *Smiths 17, 378.*

CENCHRUS ECHINATUS L. Kick 'em Jenny, *Howard 10793;* Carriacou, *Howard 10805;* Cannouan, *Howard 11070;* Bequia, *Smiths 345;* Mustique, *Smiths 58.*

A common grass with prostrating radiating stems found on rocky outcrops and ridge summits.

CHLORIS INFLATA Link. Petit Martinique, *Howard 10917.*

A dominant grass on this island where the soil is relatively deep.

CHLORIS RADIATA (L.) Sw. Bequia, *Smiths 358.*

CYNODON DACTYLON (L.) Pers. Bequia, *Smiths 362;* Mustique, *Smiths 56.*

DACTYLOCTENIUM AEGYPTIUM (L.) Richt. *Eleusine aegyptiaca* sensu Smith. Isle of Ronde, *Howard 10728;* Union, *Smiths 42!;* Bequia, *Smiths 355;* Mustique, *Smiths 57.*

DIGITARIA HORIZONTALIS Willd. *Panicum horizontale* sensu Smith. Union, *Smiths 40;* Bequia, *Smiths 375;* Mustique, *Smiths 59.*

ELEUSINE INDICA (L.) Gaertn. Union, *Smiths 48;* Bequia, *Smiths 354;* Mustique, *Smiths 60.*

ECHINOCHLOA COLONUM (L.) Link. *Panicum colonum* sensu Smith. Tobago Cays, *Howard 11025;* Bequia, *Smiths 21, 367;* Mustique, *Smiths 67.*

This species dominates the savannah area on West Island of the Tobago Cays and is visible from the air.

ERAGROSTIS CILIARIS (L.) Link. Carriacou, *Howard 10807;* Union, *Smiths 46;* Bequia, *Smiths 363!, 364.*

A characteristic plant of dry open hilltops.

ERAGROSTIS sp. Bequia, *Smiths 361.*

This plant is cited and unidentified in the Kew Bulletin report of the Smiths collections. I have not been able to locate this collection in any American herbaria.

ERIOCHLOA POLYSTACHYA HBK. Bequia, *Smiths 20, 25.*

LASIACIS DIVARICATA (L.) Hitchc. Cannouan, *Howard 11100;* Bequia, *Howard 11276.*

A high climbing bamboo type grass of dry wooded hillslopes. The mature fruits are black.

LEPTOCHLOA FILIFORMIS (Lam.) Beauv. *Leptochloa mucronata* sensu Smith. Union, *Smiths 47;* Bequia, *Smiths 373, 374.*

OPLISMENUS HIRTELLUS (L.) Beauv. Bequia, *Howard 11264.*

This grass is abundant in patches on hillslopes on the northwest corner of Bequia.

PANICUM FASCICULATUM Sw. Bequia, *Smiths 22!, 366, 369.*

PANICUM MAXIMUM Jacq. Isle of Ronde, *Howard 10758;* Tobago Cays, *Howard 11028;* Mustique, *Smiths 68.*

A stand of this grass was found on West Island of the Tobago Cays. On the Isle of Ronde the grass was well established in cleared areas on the west side of the island where it was pulled, roots and all, and laid in an opening spiral pattern to dry. Complete clumps were used for thatch when dry.

PANICUM REPTANS L. *Panicum prostratum* sensu Smith. Cannouan, *Smiths 23;* Bequia, *Smiths 19;* Mustique, *Smiths 63.*
PASPALUM ARUNDINACEUM Poir. Tobago Cays, *Howard 11026.*
A rare grass of the coastal rocks on West Island.
PASPALUM CONJUGATUM Berg. Bequia, *Smiths 377.*
PASPALUM CAESPITOSUM Flügge. Bequia, *Smiths 376.*
PASPALUM DISTICHUM L. Bequia, *Smiths 22!, 359, 360.*
PASPALUM FIMBRIATUM HBK. Union, *Smiths 50.*
PASPALUM PROPINQUUM Nash. *Paspalum setaceum* sensu Smith. Mustique, *Smiths 62.*
PASPALUM VIRGATUM L. Bequia, *Smiths 357.*
PENNISETUM PURPUREUM Schumach. "Elephant grass."
This species has been introduced recently into Cannouan by the Agricultural Experiment Station on that island. It has been accepted by the inhabitants of the island as a forage grass and is being planted widely.
PENNISETUM SETOSUM (Sw.) L. C. Rich. Bequia, *Smiths 348.*
PHARUS GLABER HBK. *Pharus brasiliensis* sensu Smith. Bequia, *Smiths 350.*
SETARIA SETOSA (Sw.) Beauv. *Setaria caudata* sensu Smith. Bequia, *Smiths 367, 371!.*
SPOROBOLUS VIRGINICUS (L.) Kunth. Union, *Smiths 45;* Cannouan, *P. Beard 1425!;* Bequia, *Smiths 365,* Mustique, *Smiths 55.*
TRICHACHNE INSULARIS (L.) Nees, *Panicum leucophaeum* sensu Smith. Union, *Smiths 43, 44;* Bequia, *Smiths 23, 356.*
VETIVERIA ZIZANIOIDES (L.) Nash. "Khus Khus grass."
This plant, introduced as a soil binder and planted in contour rows for erosion control, was seen on Carricou, Cannouan and Bequia. A few additional plants were seen under cultivation near houses on Isle of Ronde, Union and Mustique where the plants were used only for the aromatic roots considered to be useful in protecting clothing from moths.

CYPERACEAE

ABILDGAARDIA MONOSTACHYA (L.) Vahl. *Fimbristylis monostachya* sensu Smith. Petit St. Vincent, *Howard 10894;* Union, *Howard 10994;* Cannouan, *Smiths 21;* Bequia, *Smiths 342!;* Mustique, *Smiths 51.*
CYPERUS COMPRESSUS L. Isle of Ronde, *Howard 10723;* Cannouan, *Smiths 22.*
The collection number 22 has been given to four species in the Kew Bulletin list.
CYPERUS ELEGANS L. *Cyperus viscosus* sensu Smith. Bequia, *Smiths 341.*
CYPERUS LIGULARIS L. *Mariscus rufus* sensu Smith. Bequia, *Smiths 337!;* Mustique, *Smiths 54.*
CYPERUS PLANIFOLIUS L. C. Rich. Kick 'em Jenny, *Howard 10785;* Carriacou, *Howard 10957.*
CYPERUS POLYSTACHYUS Rottb. *Pycreus polystachyus* sensu Smith. Bequia, *Smiths 347.*
CYPERUS ROTUNDUS L. Bequia, *Smiths 338;* Mustique, *Smiths 53.*

DICHROMENA CILIATA Vahl. Bequia, *Smiths 346!*
FIMBRISTYLIS ANNUA (All.) R. & S. *Fimbristylis diphylla* sensu Smith. Union, *Howard 11002;* Bequia, *Smiths 339.*
FIMBRISTYLIS FERRUGINEA (L.) Vahl. Union, *Howard 10997;* Mustique, *Smiths 52.*
FIMBRISTYLIS SPATHACEA Rottb. Carriacou, *Howard 10954.*
SCLERIA LITHOSPERMA Sw. Cannouan, *Howard 11077;* Bequia, *Howard 11233, Smiths 340;* without locality, *J. Beard 621!*

A characteristic tufted plant of open dry woodlands usually at higher elevations. Common near the summit of Mt. Royal on Cannouan.
SCLERIA PTEROTA Presl. *Scleria pratensis* sensu Smith. Bequia, *Smith 343, 353.*

PALMAE

ACROCOMIA ACULEATA (Jacq.) Lodd. "Gro-Gro."

J. Beard (Carib. For. **5:** 51. 1944) reports this palm in the Grenadines. I did not see specimens of it in the field and the Bailey Hortorium has no record of this palm from that area.
COCOS NUCIFERA L. "coconut."

The coconut is only sporadically established on the islands of the Grenadines. Dr. Nichols reports in his diary the occurrence of the crown disease of coconuts in 1891 which at that time had practically destroyed all the earlier plantings. Following the decline of the sugar industry the coconut was widely planted as a commercial crop and around 1880 fruits were shipped to Trinidad and Barbados. Today coconuts are imported into all of the Grenadines where the mature meat is used as a source of oil in cooking practices.

EUTERPE GLOBOSA Gaertn.

J. Beard (Carib. For. **5:** 51. 1944) cites this palm as occurring in the Grenadines. I did not see specimens of this plant in the field and have not been able to find any in the American herbaria.
ROYSTONEA OLERACEA (Jacq.) Cook.

A few specimens of this palm were seen on Carriacou in the Limlair and Mt. Pleasant valleys. It is called "palmiste" locally and the fruits are collected for hog feed. While the natives all know the cabbage of the palm is good to eat the few remaining trees are protected by private ownership of the lands on which they occur. Some of the older residents of Carriacou report the island once had many trees of "palmiste" but that they were cut down for food during seasons of poor crops around 1910. Dr. Nichols reports in his diary that the trees were abundant in 1891.

LEMNACEAE

LEMNA PERPUSILLA Torr. Carriacou, *Howard 10836.* Also seen on Balliceaux.

This tiny floating plant was abundant in single water-catchment ponds on Carriacou and Balliceaux.

BROMELIACEAE

AECHMEA LINGULATA (L.) Baker. *Aechmea odora* sensu Smith. Isle of Ronde, *Howard 10749;* Kick 'em Jenny, *Howard 10784;* Carriacou, *Howard 10851;* Petit Martinique, *Howard 10929;* Cannouan, *Howard 11075;* Bequia, *Smiths 305.* Also seen on Union and the Tobago Cays.

This is an extremely abundant terrestrial bromeliad growing primarily on rocky outcrops and forming dense stands in the thorn shrub. The density of this plant coupled with the spininess of the leaves makes it a formidable barrier in many spots in the Grenadines. The leaves are commonly brilliant yellow in color and may be four feet long. The petals are white and tipped with purple. The mature fruit is a deep red color.

BROMELIA PINGUIN L.

Specimens of this plant were seen in Carriacou and Cannouan where the plant is used as a hedge plant or fence row plant.

CATOPSIS FLORIBUNDA (Brongn.) L. B. Smith, Bequia, *Howard 11235, 11285.*

The dominant epiphytic plant on the southwest ridge of Bequia.

PITCAIRNIA LATIFOLIA Ait. Union, *Howard 10984;* Bequia, *Howard 11255.*

On Union Island this plant was found only on the steep north face of the Pinnacle near the crest. In accessible spots the foliage is browsed by the goats and the plants never flower. On the sheer cliff face, however, the handsome pink to red inflorescences and flowers develop normally. On Bequia the specimens were found on the dry hillsides southwest of Port Elizabeth.

TILLANDSIA FASCICULATA SW. Bequia, *Howard 11234.*

TILLANDSIA FLEXUOSA SW. Isle of Ronde, *Howard 10712;* Carriacou, *Howard 10861;* Union, *Howard 11016.* Also seen on Mayero.

This epiphyte with its twisted spirally arranged leaves occurs in dry woodlands. It is not abundant but is easily recognized by its habit.

TILLANDSIA USNEOIDES L. Union, *Howard 11121.*

This collection consists of a single filament of the Spanish Moss found lodged in the rocks at the crest of the Pinnacle on Union Island. The species has not become established anywhere in the Grenadines.

TILLANDSIA UTRICULATA L. Isle of Ronde, *Howard 10719;* Petit St. Vincent, *Howard 10895;* Tobago Cays, *Howard 11022;* Kick 'em Jenny, *Howard 10781;* Bequia, *Smiths 304;* Mustique, *Howard 11222.* Also seen on Carriacou, Union and Cannouan.

This species is the most common bromeliad and epiphyte in the Grenadines. The plants are small with inflorescences two to three feet long and never reach the size of the same species in the Greater Antilles. Wind damage to the young inflorescence,

especially in plants on the exposed windward coasts of the islands, produces a striking fasciation and contortion of the inflorescence.

COMMELINACEAE

ANEILEMA GENICULATA (Jacq.) Woods. Cannouan, *Howard 11099.*

A prostrate plant with the stem tips ascending. The above collection was made near the summit of Mt. Royal where the white flowered plant was abundant in dry woodlands.

CALLISIA REPENS L. Isle of Ronde, *Howard 10773;* Union, *Howard 10985.* Also seen on Carriacou and Cannouan.

A prostrate or repent plant with erect inflorescences and white flowers. Specimens were seen only on exposed rocks on windward coasts.

COMMELINA ELEGANS HBK. *Commelina virginica* sensu Smith. Isle of Ronde, *Howard 10769;* Cannouan, *Howard 11097;* Bequia, *Smith 171!*

Two collections by the Smiths cited in the Kew Bulletin list, Mustique, *Smiths 50*, and Union, *Smiths 22*, have not been seen but presumably should be referred here. These plants are erect spreading or climbing herbs with stems often reaching seven feet in length. They are usually found on rocky outcrops climbing in the thorn shrub of the area.

RHOEO DISCOLOR Hance, Bequia, *Smiths 14.* This plant was also seen cultivated on Carriacou and Mayero.

LILIACEAE

ALOE VERA L. *Aloe barbadensis* sensu Nichols.

Dr. Nichols reports in his diary the extensive cultivation of Aloe in the Grenadines in 1891. Plants residual to former cultivation were seen on White Island, and others, under cultivation today, were observed on Carriacou, Union and Bequia.

SMILAX CUMANENSIS Willd. Carriacou, *Howard 10856.*

One dense patch of *Smilax* was seen on the southern end of Carriacou. All plants were sterile in March and the determination is tentative.

AMARYLLIDACEAE

AGAVE CARIBAEICOLA Trel. Isle of Ronde, *Howard 10718.*

Numerous plants, presumably referable to this species were seen on Carriacou, Cannouan, Mayero, Union, Tobago Cays and Bequia. Only the Isle of Ronde specimens were in flower and could be identified. The plants occur on the rocky cliffs on the windward sides of the islands. The inflorescence in the few specimens which were not broken or contorted by the wind reached fifteen feet in height. The flowers were yellow and only a few plants remained in flower in March.

FURCRAEA CUBENSIS Haw. Bequia, *Smiths*, without number.

This species was introduced into the Grenadines as a crop plant prior to 1870. Some specimens are used as fence row plants today and a few are cultivated as single ornamentals. The plant is known locally as "dagger bush" or "silk grass" but it is not used as a source of fiber.

HYMENOCALLIS SPECIOSA Salisb. *Hymenocallis caribaea* sensu Smith. Carriacou, *P. Beard 1209!;* Bequia, *Smiths 306!; Howard 11259.*

The Caribbean species of *Hymenocallis* are in need of careful revisionary study. It seems preferable to refer these specimens to *H. speciosa.*

IRIDACEAE

TRIMEZIA MARTINICENSIS (Jacq.) Herb. Bequia, *Howard 11236.*

An abundant plant in one small area of the ridge southwest of Port Elizabeth. The plant occurs in dense thorn shrub and is attractive with yellow flowers spotted with brown. The corm has an acrid yellow juice.

ORCHIDACEAE

BRASSAVOLA CUCULLATA (L.) R. Br. Isle of Ronde, *Howard 10771;* Petit St. Vincent, *Howard 10901;* Union, *Smiths 13;* Cannouan, *Howard 11085;* Mustique, *Smiths 69, Howard 11227.*

A common epiphyte on trees of the thorn shrub vegetation throughout the Grenadines. The plants are found less frequently on rocks.

EPIDENDRUM CILIARE L. Union, *Howard 10982;* Cannouan, *Howard 11074;* Bequia, *Howard 11250, 11279, Smiths 303.*

By contrast with *Brassavola* this orchid, the most common one in the Grenadines, occurs most abundantly on the open rock faces on all of the islands. A few plants were found in flower, presumably off-season, in March.

ONCIDIUM CEBOLLETA (Jacq.) Sw. Bequia, *Howard 11281.*

An epiphytic orchid found only on the extreme northeast tip of Bequia. The lip was yellow and the other perianth segments had large brown spots on a yellow base.

ONCIDIUM LURIDUM Lindl. Bequia, *Howard 11283.*

This orchid too was found only at the extreme northeast tip of Bequia. Plants were found growing on the rocks or as epiphytes on trees. The inflorescence averaged six feet in length in the specimens seen.

PIPERACEAE

PEPEROMIA MAGNOLIAEFOLIA (Jacq.) Dietr. Bequia, *Howard 11270.*

This stout herbaceous plant was found growing in valleys in the southwest peninsula of Bequia in association with *Peperomia Rupertiana.*

PEPEROMIA PELLUCIDA (L.) HBK.

This species was sent to me by Dr. Kulesza from the island of Bequia. The plant is known there as "silver bush" and is used to make a "nutri-

tional tea for children." I do not know whether it was wild or under cultivation.

PEPEROMIA RUPERTIANA C. DC. Bequia, *Howard 11251, Smiths 244.*

This species was found in valleys on the dry hillslopes of the southwest peninsula of Bequia. The leaves were conspicuously three-veined when fresh.

PEPEROMIA SINTENISII C. DC. Bequia, *Howard 11252.*

A fleshy herbaceous plant with pinnately veined leaves growing on rocks in the hillside ravines of the southwest peninsula.

PIPER DILATATUM L. C. Rich. Bequia, *Smiths 245, 246, Howard 11260.*

A semi-woody plant to ten feet tall growing on the wooded hillsides of the northeast peninsula.

ULMACEAE

CELTIS IGUANAEA (Jacq.) Sarg. *Celtis aculeata* sensu Smith. Isle of Ronde, *Howard 10757;* Petit Martinique, *Howard 10927;* Bequia, *Smiths 73, 74, 107.* Also seen on Union.

A twenty foot tree with scrambling branches or an arching shrub with climbing branches to seventy-five feet long. The secondary branches are flat or strongly curved. The entire plant is armed with sharp numerous spines. The flowers are greenish-yellow.

MORACEAE

BROSIMUM ALICASTRUM Sw.

Beard reports this species growing abundantly on Carriacou (Oxford For. Mem. **21:** 146. 1949).

CECROPIA PELTATA L. Bequia, *Smiths 100.*

FICUS LAEVIGATA Vahl. *Ficus populnea* sensu Smith. Kick 'em Jenny, *Howard 10786;* Carriacou, *Howard 10839;* Petit Martinique, *Howard 10931;* White Island, *Howard 10967;* Union, *Howard 10981;* Cannouan, *Howard 11062;* Bequia, *Smiths 54, 55;* Mustique, *Smiths 122.*

A common tree of rocky outcrops usually abundant on ridges and crests of hills. The plants vary considerably in general habit and conspicuously so in the color of the mature fruit. Pure white fruits were found on specimens from Union while the majority of the plants on the other islands had tan or yellow fruits.

FICUS LAEVIGATA Vahl, var. LENTIGINOSA Urb. *Ficus lentiginosa* sensu Beard.

Beard (1949, 146) reports this tree to be of occasional occurrence on Carriacou. A specimen collected by *Fairchild (2794)* on Cannouan can also be referred to this variety.

URTICACEAE

FLEURYA AESTUANS (L.) Gaud. Carriacou, *Howard 10937;* Bequia, *Smiths 174.*

A broad-leafed herb, to one foot tall, of wooded hillsides. The plant is well armed with stinging hairs.

PILEA MICROPHYLLA (L.) Liebm. Union, *Howard 11015;* Cannouan, *Howard 11072;* Bequia, *Smiths 201;* Mustique, *Smiths 31.*

The plant is known locally as "chick weed" and used medicinally to treat diarrhoea in children. The name is distinctive in contrast with "check weed" applied to species of the Euphorbiaceae used in treating the same ailment in adults. This red flowered herb is usually found on rocky outcrops of higher altitudes or in open dry woodlands on rocks.

OLACACEAE

SCHOEPFIA SCHREBERI Gmel. *Schoepfia arborescens* sensu Smith. Cannouan, *Howard 11118;* Union, *Smiths 14;* Bequia, *Howard 11232, Smiths 148.*

Specimens seen of this plant were fifteen to eighteen foot trees usually found in the open shrubland of the dry windward coasts. The leaves are characteristically curved and partially folded and relatively fleshy. The flowers have red-orange lobes to the perianth. The perianth tube is orange-yellow when fresh.

LORANTHACEAE

PHORADENDRON TRINERVIUM (Lam.) Griseb. *Dendrophthora myrtilloides* sensu Smith. Isle of Ronde, *Howard 10760;* Cannouan, *Howard 10853, P. Beard 1420!;* Tobago Cays, *Howard 11023;* Bequia, *Smiths 307;* Mustique, *Smiths 34.* Also seen on Carriacou.

This parasitic plant was found growing only on *Pisonia fragrans.* The mature fruits were orange or red-orange in color. Known locally as "mistletoe."

POLYGONACEAE

ANTIGONON LEPTOPUS Hook. & Arn. A cultivated vine seen on Carriacou and Union.

COCCOLOBA CARIBAEA Urb. Carriacou, *Howard 10815, 10818, 10890;* Petit St. Vincent, *Howard 10896;* Petit Martinique, *Howard 10935;* Large Island, *Howard 10965;* Union, *Howard 10988;* Tobago Cays, *Howard 11024;* Mayero, *Howard 11038;* Cannouan, *Howard 11091;* Bequia, *Howard 11231;* Mustique, *Howard 11223.*

A very common shrub or small tree. On the exposed windswept areas these plants are generally contorted, much branched, and about eight feet tall. In protected areas or in the dry woodlands this species may be the most common tree often reaching twenty feet in height with a trunk diameter of eight inches. The flowers are yellow. The fruits are yellow turning red or purple in age. About 90% of all fruits examined were inhabited by

some larva. Most of the plants seen had numerous adventitious shoots developed from the base and these had larger leaves than the normal shoots.

COCCOLOBA UVIFERA L. Kick 'em Jenny, *Howard 10782;* Petit St. Vincent, *Howard 10912;* Mayero, *Howard 11041, 11042;* Bequia, *Smiths 128;* Mustique, *Smiths 155.* Also seen on Union, Carriacou, Large, Cannouan and the Tobago Cays.

This is a common species of coral sandy beaches chiefly on the leeward coasts of the Grenadine Islands. The plant is known locally as the "seaside grape." The plant is not as abundant in the Grenadines as in the Greater Antilles. All of the plants seen in flower or fruit were completely dioecious with white flowers and purple fruit. On Mayero the plants were kept cut back in order to encourage the development of adventitious shoots which were used for weaving the framework of houses. This frame of *Coccoloba* shoots was ultimately daubed with mud.

COCCOLOBA VENOSA Jacq. Isle of Ronde, *Howard 10713, 10717;* Kick 'em Jenny, *Howard 10792.*

Coccoloba venosa is known on the Isle of Ronde as the "checker grape," a name used more frequently in the Leeward Islands. This species is the least abundant of the species of *Coccoloba* seen in the Grenadines. On the Isle of Ronde the plant is found in shrub thickets associated with *Jacquinia, Bourreria, Diospyros, Pithecellobium* and *Citharexylum.* The plants are low, rarely reaching fifteen feet in height and much branched from the base thus forming extensive but low clumps.

John Beard reports this species occurring also on Carriacou and Cannouan. Although I searched those islands I could not find this species. I have not seen any material so identified by Beard but I suspect his material must be *C. caribaea. Coccoloba caribaea* and *C. venosa* are difficult to distinguish in sterile condition.

COCCOLOBA sp. Bequia, *Smiths 40, 136.* I have not seen these collections of the Smiths but suspect they are to be referred to *C. caribaea.*

CHENOPODIACEAE

CHENOPODIUM AMBROSIOIDES L. Specimens of this weedy species were seen on Carriacou, Union and Bequia.

The species is known locally as "worm grass" and is widely used in making a tea to eliminate worms in children.

AMARANTHACEAE

ACHYRANTHES INDICA (L.) Mill. *Achyranthes aspera* sensu Smith. Bequia, *Smiths 218!* Also seen on Carriacou and Cannouan.

This species is known as "anti lala" or "man better man." The leaves are used in making a tea given for malnutrition in children and a tea of the leaves and the roots is used for the treatment of colds in infants.

ALTERNANTHERA BRASILIENSIS (L.) Ktze. *Mogiphanes straminea* sensu Smith. Bequia, *Smiths 289;* Mustique, *Smiths 16.* I have not seen these specimens but have suggested the currently acceptable name for the earlier identification.

ALTERNANTHERA MARITIMA (Mart.) St. Hill. *Telanthera maritima* sensu Smith. Mustique, *Smiths 17.* Specimens not seen.

ALTERNANTHERA OLIVACEA Urb. Carriacou, *Howard 10881.*

A prostrate herb of open grassy areas.

ALTERNANTHERA POLYGONOIDES (L.) R. Br. Isle of Ronde, *Howard 10730.*

A prostrate plant commonly rooting at the nodes.

ALTERNANTHERA RAMOSISSIMA (Mart.) Chod. Isle of Ronde, *Howard 10725, 10759;* Carriacou, *P. Beard 1211!;* Mayero, *Howard 11045;* Cannouan, *Howard 11098, P. Beard 1418!.* Also seen on Union, Tobago Cays and Bequia.

A climbing or scrambling herb with fleshy and fragile stems and fleshy leaves. The stems may be six feet long. The entire plant is generally brightly colored with reds and purples predominating. The leaves are used as a nutritional tea for infants and the plant is known as "baby bush."

ALTERNANTHERA sp. Bequia, *Smiths,* without number; Mustique, *Smiths 14.*

These specimens cited in the Kew Bulletin list were not found in the herbaria visited.

AMARANTHUS DUBIUS Mart. *Amaranthus tristis* sensu Smith. Carriacou, *Howard 10961;* Bequia, *Smiths 228, 229;* Mustique, *Smiths 5.*

AMARANTHUS SPINOSUS L. Bequia, *Smiths 226.*

AMARANTHUS VIRIDIS L. Bequia, *Smiths 227.* I have not seen this specimen but suspect it might well be *A. ascendens* Loisel. and not *A. viridis* L.

LITHOPHILA MUSCOIDES Sw. Balliceaux, *Howard 11291.*

A prostrate coastal herb on coral rocks.

PHILOXERUS VERMICULARIS (L.) Nutt. Carriacou, *Howard 10884;* Union, *Smiths 39;* Bequia, *Smiths 302;* Mustique, *Smiths 30.*

A prostrate coastal herb rooting freely at the nodes. The leaves and stems are red.

NYCTAGINACEAE

BOERHAAVIA ERECTA L. Cannouan, *Howard 11115;* Bequia, *Smiths 192, 194!.* Also seen on Carriacou, Union, Mayero and the Tobago Cays.

A partially ascending weed of open areas and old cultivated fields. The flowers are pink and the fruits viscid pubescent.

BOERHAAVIA PANICULATA Rich. Carriacou, *Howard 10804.*

Stems completely prostrate. Flowers pink. Leaves succulent.

MIRABILIS JALAPA L. Bequia, *Smiths 309*. Also seen on Carriacou and Union.

All of the specimens seen were under cultivation; however, on other islands in the Lesser Antilles this plant has escaped and become generally established along roadsides.

PISONIA ACULEATA L. Isle of Ronde, *Howard 10770;* Carriacou, *Howard 10823;* Mustique, *Howard 11225, Smiths 49*.

A woody vine of shrub areas forming dense tangles. The plants have straight or recurved, sharp spines and are dangerous. The mature fruits are viscid or sticky pubescent with large glands.

PISONIA FRAGRANS Dum. Cours. *Pisonia nigricans* sensu Smith. Isle of Ronde, *Howard 10761;* Kick 'em Jenny, *Howard 10788;* Carriacou, *Howard 10883;* Bequia, *Smiths 58;* Mustique, *Smiths 151*. Also seen on Cannouan and the Tobago Cays.

This species is known locally as "mapu" or "mapoo." It is one of the most common plants found in the dry woodlands in the Grenadines principally because the wood is worthless even for firewood. The plants are trees, fifteen to twenty feet tall. The leaves, even on a single plant, show considerable variation in size, shape and thickness.

PHYTOLACACEAE

PETIVERIA ALLIACEA L. Bequia, *Smiths 220!*.

RIVINA HUMILIS L. *Rivina laevis* sensu Smith. Cannouan, *Smiths 15;* Bequia, *Smiths 181!*. Also seen on Carriacou, Union, Mayero and the Tobago Cays.

TRICHOSTIGMA OCTANDRUM (L.) Walter, *Villamilla octandra* sensu Smith. Isle of Ronde, *Howard 10710;* Carriacou, *Howard 10886;* Petit Martinique, *Howard 10920;* Bequia, *Smiths 129!;* Mustique, *Smiths 35*.

Specimens of this plant were found in mangrove swamps, in dry open woodlands, and in wet river vallies. The plants are climbing or scandent woody vines with branches often reaching twenty-five feet in length. The flowers are pink fading to white.

AIZOACEAE

SESUVIUM PORTULACASTRUM L. Cannouan, *Smiths 10!;* Bequia, *Smiths 6*. Also seen on Union, Mayero, Carriacou and the Tobago Cays.

TRIANTHEMA PORTULACASTRUM L. *Trianthema monogynum* sensu Smith. Isle of Ronde, *Howard 10726;* Union, *Howard 10990;* Balliceaux, *Howard 11290;* Cannouan, *Smiths 14*.

A fleshy prostrate herb with trailing stems. It occurs on open coral or mud flats where it is sprayed with sea water or in prostrate-herb areas where it is generally associated with *Pectis humifusa* and *Euphorbia prostrata*. The flowers are pink and are open for a very short time. The natives on the Isle of Ronde report the sea turtles come ashore to eat this plant, hence the local name of "turtle weed."

PORTULACACEAE

PORTULACA OLERACEA L. Isle of Ronde, *Howard 10732*, Cannouan, *Howard 11071;* Mustique, *Smiths 25.*

In the Greater Antilles *P. oleracea* is a weed of old fields, roadsides and waste areas. In the Grenadines the material referred to this species is found only on rock outcrops in protected areas. The specimens from Cannouan were growing on bare rock at the summit of Mt. Royal. These plants were smaller than those of the Greater Antilles, had smaller leaves and a larger tap root which was brown and shiny. The petals were yellow and the seeds black. In general aspect they appear to be quite different from the northern *P. oleracea* but there are no technical differences to distinguish them.

PORTULACA QUADRIFIDA L. Carriacou, *Howard 10880.*

PORTULACA PILOSA L. Bequia, *Smiths 247.*

TALINUM PANICULATUM (Jacq.) Gaertn. *Talinum patens* sensu Smith. Petit Martinique, *Howard 10928;* Union, *Howard 11010;* Bequia, *Smith,* without number.

This is a rare herb found growing on rocks usually near the summits of the islands. The flowers are pink.

MENISPERMACEAE

CISSAMPELOS PAREIRA L. Carriacou, *Howard 10862.*

A scrambling semi-herbaceous vine of wooded areas.

ANNONACEAE

ANNONA MURICATA L. Bequia, *Smiths 56;* Mustique, *Smiths 157.*

Known locally as the "sour sop" and cultivated for its edible fruits. The leaves of this plant are used to make a tea which is considered an excellent treatment for colds, fevers, to stop vomiting, as a sedative and for "cooling the blood."

ANNONA RETICULATA L.

Plants were seen on Carriacou and Cannouan persisting after former cultivation.

ANNONA SQUAMOSA L. Carriacou, *Howard 10826;* Bequia, *Smiths 151;* Mustique, *Smiths 156.*

This plant is known locally as "apple bush" or less frequently as "custard apple." The leaves are brewed into a tea which is taken in place of water in the treatment of amenorrhea.

LAURACEAE

CASSYTHA FILIFORMIS L. White Island, south of Carriacou, *Howard 10972;* Union, *Howard 11123;* Mustique, *Smiths 46.* Also seen on Bequia.

This is one of the dodder plants which must be exterminated by the land owners under penalty of the Grenada law. The only extensive patch

of this dodder, however, was seen on Union Island in St. Vincent territory. There the plant covered some of the coastal shrubs. The host plant was either *Coccoloba uvifera* or *Pithecellobium unguis-cati* in all cases.

NECTANDRA CORIACEA Griseb. *Nectandra Willdenoviana* sensu Smith. Bequia, *Smiths 51, 52.* Also seen on Cannouan.

This species formed a conspicuous element of the dry woodland on the northeast corner of Bequia in March. The trees were in full bloom in the woods with the white aromatic flowers attracting swarms of bees and humming birds. It was said locally to be a good honey plant.

PAPAVERACEAE

ARGEMONE MEXICANA L. Bequia, *Smiths 233.* Also seen on Carriacou, Union, Mayero and Cannouan.

A common white flowered weed of old cultivated areas.

CAPPARIDACEAE

CAPPARIS BADUCCA L. Isle of Ronde, *Howard 10753;* Petit Martinique, *Howard 10918.*

The few plants seen were shrubs and were about eight feet tall. When injured or cut this plant sends out long and fast-growing adventitious shoots which are apt to climb or scramble through the adjacent shrubs. It is these adventitious shoots that give the plant the common name of "rope." The scrambling shoots are cut and either stripped of their bark or used whole for tying buoys to fish or lobster traps. Single shoots thirty feet long were seen in use on the Isle of Ronde. The native fishermen report such lengths are common but their location is jealously guarded for personal use.

CAPPARIS COCCOLOBIFOLIA Mart. Isle of Ronde, *Howard 10740;* Kick 'em Jenny, *Howard 10789;* Carriacou, *Howard 10846;* Mayero, *Howard 11043;* Cannouan, *Howard 11090, Smiths 4!;* Balliceaux, *Howard 11289.*

This is one of the handsome trees of the open shrub land and is found throughout the Grenadines. The plants were shrubs to trees, five to twenty feet tall. The branches are usually crooked giving the trees a coarse appearance. *Capparis coccolobifolia* was the only real tree seen on Balliceaux.

The collection made by the Smiths, number *4*, is listed as *Capparis cynophallophora* in Kew Bulletin 236. 1893. Also cited under this name in the same reference are *Smiths 131* from Bequia and *Smiths 116* from Mustique. I have not seen these latter collections but feel they belong here. *Capparis cynophallophora* L. is quite a different plant from the species seen in the Grenadines.

CAPPARIS FLEXUOSA L.

This species is reported by Beard (Caribbean Forester **5:** 53. 1944) to occur in the Grenadines. I have seen no material of this species in the field or in the herbaria examined and would suspect that any plant so determined should be referred to *C. coccolobifolia*. The two species are similar and may be hard to distinguish in sterile or flowering condition.

CAPPARIS INDICA (L.) Fawcett & Rendle, *Capparis amygdalina* sensu Smith. Carriacou, *Howard 10816;* Mustique, *Smiths 118.*

CAPPARIS ODORATISSIMA Jacq., *Capparis jamaicensis* sensu Smith. Isle of Ronde, *Howard 10741;* Carriacou, *Howard 10796;* Petit St. Vincent, *Howard 10900;* Cannouan, *Smiths 7!;* Mustique, *Smiths 117!.*

The collections made by the Smiths bearing the numbers *7* and *117* are cited in Kew Bulletin 236. 1893 as *C. jamaicensis*. *Capparis jamaicensis* Jacq. is now referred to the synonymy of *C. cynophallophora* L., quite a distinct species. I have not seen the specimens of *Smiths 17* and *Powell 91* from Union Island, also cited as *C. jamaicensis* but suspect they too should be referred to this species.

Capparis odoratissima occurs as a fifteen to twenty foot tree of open dry hillsides. The leaves are bronze-green above and silvery below. The flowers change from white when young to red or purple in age. The trees are extremely attractive.

CLEOME GYNANDRA L., *Gynandropsis pentaphylla* sensu Smith. Bequia, *Smiths 175!.* Also seen on Carriacou as a weed of old fields.

CLEOME SPINOSA Jacq., *Cleome pungens* sensu Smith. Bequia, *Smiths 176!.*

CLEOME VISCOSA L., *Polanisia viscosa* sensu Smith. Bequia, *Smiths 177!.*

CRATAEVA TAPIA L., *Cratava gynandra* sensu Smith. Bequia, *Smiths 146!.*

Reported to be a cultivated plant. It was not seen in 1950.

MORISONIA AMERICANA L. Carriacou, *Howard 10877;* Tobago Cays, *Howard 11027.*

The specimen from Carriacou was a fifteen foot tree with a well developed and rounded crown found on the windblown crests at the southern end of the island. The specimen from the Tobago Cays was on the windward edge of west island and showed the effects of the persistent winds. It was only six feet tall with long trailing branches which extended over the exposed coral rocks or scrambled through the shrub growth to the lee of the plant. The flowers are inconspicuous and cream colored but the fruits, almost the size of a tennis ball when mature, are distinct for their foul and foetid odor when ripe. The plant is known locally as "jumbie sapodilla" or "dog sapodilla."

CRUCIFERAE

CAKILE LANCEOLATA (Willd.) O. E. Schulz. Union, *Howard 11001.*

A white flowered succulent herb found on sandy or coral outcrops along the coast.

LEPIDIUM VIRGINICUM L. Carriacou, *Howard 10936*.
A roadside weed which is not abundant.

MORINGACEAE

MORINGA OLEIFERA Lam., *Moringa pterygosperma* sensu Smith. Bequia, *Smiths 332*. Also seen on Carriacou, Union and Cannouan.

While the common name of "horseradish tree" is used throughout the Grenadines for this plant the inhabitants had no explanation for the name and did not use the plant. It was admired for its flowers and when it is in full white bloom the plant is truly spectacular. The children all knew the explosive nature of the long fruits and used them for playthings. The tree was commonly planted near houses as an ornamental. In other areas of the Caribbean, the leaves, flowers and young fruits are used as greens for food and the roots are used to make a hot sauce.

CRASSULACEAE

BRYOPHYLLUM PINNATUM (Lam.) Kurz., *Bryophyllum calycinum* sensu Smith. Bequia, *Smiths*, without number; Mustique, *Smiths 1*. Also seen on Carriacou, Union and Cannouan.

A common roadside weed usually in the damp or shaded areas in ravines or wooded thickets.

ROSACEAE

CHRYSOBALANUS ICACO L.

A few plants of this species were seen on the south end of Carriacou.

LEGUMINOSAE

MIMOSOIDEAE

ALBIZZIA CARIBAEA (Urb.) Britton and Rose, *Pithecellobium caribaea* Urb.
Specimens of this plant were seen on Carriacou, Union, Mayero and the Tobago Cays. The plants were not in flower or fruit in March.
ALBIZZIA LEBBEK (L.) Benth. Mayero, *Howard 11050;* Bequia, *Smiths 279!*. Also seen on Union.
Only one or two specimens of this plant were seen on the islands cited, obviously under cultivation.
ACACIA FARNESIANA (L.) Willd. Carriacou, *Howard 10947*.
This plant was locally abundant on the southern end of the western coast of Carriacou in association with *Avicennia*, *Conocarpus* and *Pithecellobium unguis-cati* on sandy beach areas.
ACACIA MACRACANTHOIDES Bert., *Acacia lutea* (Mill.) Hitchc. Petit St. Vincent, *Howard 10899;* Carriacou, according to Beard in the Oxford For. Mem. **21**: 147. 1949.
A rare plant on Petit St. Vincent characterized by its erect fruits.
ACACIA NILOTICA Delile, *Acacia arabica* sensu Smith. Isle of Ronde,

Howard 10775; Cannouan, *P. Beard 1424!, Smiths 26;* Mustique, *Smiths 108!;* Union, *Smiths 3.* Also seen on Carriacou and Bequia.

A common tree of old cultivated fields. The fruit is characteristically gray-green, pendant and moniliform.

ACACIA TAMARINDIFOLIA (L.) Willd. Carriacou, *Howard 10801, P. Beard 1210!;* Mustique, *Smiths 110.* Also seen on Cannouan and Bequia.

An attractive and very abundant plant with scrambling habit. The gray to tan branches are densely armed with sharp, often recurved prickles.

ADENANTHERA PAVONINA L. Carriacou, *Howard 10863;* Bequia, *Smiths 333.*

The Carriacou specimen was a forty foot tree with brilliant red seeds, so shiny they appeared lacquered. The bipinnately compound leaves are stewed to form a tea used in the treatment of colds. The local name for the tree is "L'eglise."

CALLIANDRA PURPUREA Benth. Petit St. Vincent, *Howard 10908;* Bequia, *Smiths 285!.* Also seen in abundance on Union Island.

A shrub reaching ten feet in height with attractive brilliant red flowers, the color being in the filaments of the stamens.

DESMANTHUS DEPRESSUS H. B. K. Carriacou, *Howard 10870;* Cannouan, *Howard 11114, Smiths 25;* Mustique, *Smiths 98, 104.*

A prostrate herb of coastal rock outcrops or windward slope grassy areas.

DESMANTHUS VIRGATUS Willd. Tobago Cays, *Howard 11035;* Bequia, *Smiths 281!, 282;* Mustique, *Smiths 95.*

A herb of dry hillsides or in the thorn shrub on limestone outcrops.

INGA LAURINA (Sw.) Willd. Cannouan, Beard (Oxford For. Mem. **21:** 140. 1949).

I did not see this plant on the slopes of Mt. Royal although Beard reports it to be of frequent occurrence. No herbarium specimens are available from the Grenadines.

LEUCAENA GLAUCA (L.) Benth. Isle of Ronde, *Howard 10751;* Mustique, *Smiths 106!;* Bequia, *Smiths 271.* Also seen on Cannouan.

One of the most common shrubs found in almost pure stands in some formerly cultivated fields. The local name for this plant is "wild tamarind."

LYSILOMA sp. Cannouan, *Smiths 24.*

The Smiths' collection cited above is listed without further determination in the Kew Bulletin, 1893. I have not been able to find this collection in the herbaria examined.

NEPTUNIA PLENA Benth. Union, *Smiths 2.*

This distinctive plant could not be located on Union Island in 1950 and was not seen elsewhere in the Grenadines.

PITHECELLOBIUM ARBOREUM (L.) Urb.

Dr. Nichols reports the occurrence of this plant on Union Island, under the name of *P. filicifolium* in his diary of 1891. He was certainly familiar with the species as it cocurs on Dominica but recent collectors have not reported it from the Grenadines. It is likely that this tree has been com-

pletely removed by civilization since the wood is prized for lumber on other islands.

PITHECELLOBIUM UNGUIS-CATI (L.) Willd. Union, *Howard 11007*, *Smiths 7!*, *Powell 96;* Cannouan, *Howard 11065;* Bequia, *Smiths 274;* Mustique, *Smiths 109*. Also seen on Carriacou and the Tobago Cays.

This species, locally known as "beef-steak," is perhaps the most common plant in the Grenadines in all woodlands, on the windswept eastern coasts and in the beach vegetation. The common name is derived from the extremely attractive mature open pods which show a fleshy red ovary wall contrasting with the white arils and shiny black seeds.

SAMANEA SAMAN (Willd.) Merr. Carriacou, *Howard 10939*.

Several plants of this species were seen along the ridge on Carriacou. The plant is a native of continental tropical America and appears to have been introduced into the Grenadines for its form and shade. The specimens seen were forty foot trees with broad spreading crowns. The young branches are hollow and more or less filled with a sweet blackish resin. The young pods are relished by cattle. The two common names for this species in the Grenadines are "rain tree" and "cow tamarind."

CAESALPINOIDEAE

BAUHINIA MONANDRA Kurz. Carriacou, *Beard*, without number.

BAUHINIA UNGULA Jacq. Petit St. Vincent, *Howard 10915;* Cannouan, *Smiths 11*. Also seen on Union and Mayero.

Plants of this species were very common in old cultivated fields. They became ten foot shrubs with numerous branches from the base, often very spreading in habit. The white flowers are attractive.

Britton and Rose did not consider this species in their treatment of the *Caesalpinoideae* for the North American Flora. All collections of this species which they did see were annotated by them as *Bauhinia bauhinoides*, a quite different species.

CAESALPINIA BONDUC Roxb., *Guilandina crista* (L.) Small, *Caesalpinia Bonducella* sensu Smith. Cannouan, *Howard 11093;* Mustique, *Smiths 97*. Also seen on Carriacou, Union, Mayero and the Tobago Cays.

An arching scrambling plant in the *Hippomane-Coccoloba uvifera* association on sandy areas near the coasts. A luxuriant plant, extremely spiny forming a barrier to travel through the area where it grows.

CAESALPINIA CILIATA (Berg.) Urb. *Guilandina ciliata* Berg.

The Stehlés report this species from the Grenadines (Carib. For. **8**: 101. 1947).

CAESALPINIA CORIARIA (Jacq.) Willd. Union, *Howard 10976*.

Scattered trees of this species were found on Union Island. The plants were twenty feet tall and known locally as "divi divi." The plant was introduced prior to 1891 for Dr. Nichols reports in his diary that the fruits were then collected for export to be used eventually in the tanning of leather. The 1950 crop of fruits would not have exceeded twenty-five pounds.

CASSIA BICAPSULARIS L. Isle of Ronde, *Howard 10738;* Carriacou,

Howard 10832; Bequia, *Smiths 275;* Balliceaux, *Howard 11286;* Mustique, *Smiths 115.*

This plant was a semi-woody shrub to four feet tall found generally in old cultivated fields and occasionally on the windward slopes established in the shrub growth.

CASSIA FISTULA L. Bequia, *Smiths 278.*

Cassia Fistula has been introduced into many of the islands of the Lesser Antilles as an ornamental, a fence row plant, or a source of edible pods for cattle. A few poor specimens were seen on Bequia in 1950, remanents of former cultivation.

CASSIA GLANDULOSA L. var. SWARTZII (Wichstr.) Macbr. Tobago Cays, *Howard 11033, 11034;* Cannouan, *Howard 11084;* Bequia, *Smiths 275.*

A relatively common plant of dry open woodlands or on open wind-swept slopes or on rocks close to the seacoast where they are exposed to salt spray. The habit and aspect of these plants in the field are extremely diverse varying from stunted salt-sprayed specimens, to low semi-prostrate shrubs to erect slender plants five feet tall in more protected locations.

CASSIA OBOVATA Collad. Union, *Smiths 11.*

CASSIA OCCIDENTALIS L. Bequia, *Smiths 266.*

This species, known locally as "wild coffee" was found on Bequia as a weed of old fields.

CASSIA TORA L. Bequia, *Smiths 267.* Also seen on Cannouan in old fields.

HYMENAEA COURBARIL L. Carriacou, *Howard 10865;* Bequia, *Smiths 269, 270;* Mustique, *Smiths 113, 114.*

The "locust" is a common tree reaching forty feet in height. The brown pods contain a sweet dry powdery material which is edible when mature. The fruits are commonly sold on the markets and are fancied by the children. A locust tree was one of the original boundary markers for the town of Port Elizabeth on Bequia.

HAEMATOXYLON CAMPECHIANUM L. Carriacou, *Howard 10882;* Bequia, *Smiths 272;* Mustique, *Smiths 105.* Also seen on Union and Cannouan.

This tree, with its economically important bark, was one of the principal exports of the Grenadines a century ago. A few plants remain but it is not as abundant in the Grenadines as on some of the other islands of the Lesser Antilles.

PARKINSONIA ACULEATA L. Petit St. Vincent, *Howard 10909;* Union, *Powell 97*; Cannouan, *Smiths 1;* Bequia, *Smiths 13!.*

An attractive twelve foot shrub with green leaves, twigs and mature branches and spectacular yellow flowers.

TAMARINDUS INDICA L. Bequia, *Smiths 273;* Mustique, *Smiths 107!.* Also seen on Carriacou, Union, Mayero and Cannouan.

The "tamarind" is found around current houses and all old ruins in the Grenadines. Although the flowers, leaves and fruits are edible and used for food on other islands the tree was not utilized in the Grenadines in 1950.

LOTOIDEAE

ABRUS PRECATORIUS L.

This plant was seen on Bequia where the plant is known as "liquorice." The leaves of this herbaceous vine are boiled in a sugar syrup to make a tea used in the treatment of coughs and colds.

ALYSICARPUS VAGINALIS DC. Carriacou, *Howard 10873;* Bequia, *Smiths 249!*

A prostrate plant on grassy coastal savannahs.

CANAVALIA MARITIMA (Aubl.) Thou., *Canavalia obtusifolia* sensu Smith. Bequia, *Smiths 254.*

CENTROSEMA VIRGINIANUM (L.) Benth. Carriacou, *Howard 10840;* Cannouan, *Smiths 28;* Bequia, *Smiths 252;* Mustique, *Smiths 90.* Also seen on Union.

A common white to pink flowered herbaceous vine showing great range of variation in leaf size and shape.

CHAETOCALYX SCANDENS (L.) Urban, *Chaetocalyx vincentinus* sensu Smith, Carriacou, *Howard 10845;* Union, *Smiths 10;* Mayero, *Howard 11047;* Cannouan, *Smiths 27;* Bequia, *Smiths 262!*, *Eggers 7041;* Mustique, *Smiths 91, 94.*

Perhaps the most common herbaceous vine in the Grenadines. The plant occurs as a yellow flowered weed of old cultivated fields as well as a climbing component of the dry open woodlands.

CLITORIA TERNATEA L. Union, *Smiths 4;* Bequia, *Smiths 253.*

CRACCA CARIBAEA (Jacq.) Benth. Carriacou, *Howard 10820;* Bequia, *Smiths 265.*

A white flowered woody herb to five feet tall found in dry open woodlands.

CROTALARIA INCANA L. Carriacou, *Howard 10944;* Bequia, *Smiths 256;* Mustique, *Smiths 101.* Also seen on Cannouan.

A yellow flowered herb to two feet tall generally found in the shrub zone immediately behind the sandy beaches.

CROTALARIA LOTIFOLIA L. Tobago Cays, *Howard 11030.*

An erect bush or woody herb to nine feet tall. This yellow flowered plant was found only in thickets at the summit of the ridge of north island.

CROTALARIA RETUSA L. Carriacou, *Howard 10945;* Bequia, Mustique and Union, *Smiths* specimens without numbers.

A common weed of old fields, spreading more than erect in habit with the branches often three feet long. The flowers are yellow streaked with brown.

CROTALARIA VERRUCOSA L. var. OBTUSA DC. Carriacou, *Howard 10949;* Bequia, *Smiths 263!;* Mustique, *Smiths 103;* Union, *Smiths 8.*

A two foot plant with blue flowers found on sandy beaches primarily near or in the shrub zone.

DALBERGIA ECASTAPHYLLUM Taub., *Ecastaphyllum Brownii* sensu Smith. Bequia, *Smiths 284.*

DESMODIUM CANUM (Gmel.) Schinz. & Thellb., *Desmodium incanum*

sensu Smith. Carriacou, *Howard 10834;* Union, *Howard 10983;* Mayero, *Howard 11044;* Bequia, *Howard 11274, Smiths 250.*

A common trailing roadside plant or found in thickets on hillsides in the dry woodland.

DESMODIUM GLABRUM (Mill.) DC., *Desmodium molle* (Vahl.) DC. Carriacou, *Howard 10841.*

One much browsed specimen of this plant was all that was seen in spite of considerable search for more or better material.

DESMODIUM PROCUMBENS (Mill.) Hitchc., *Desmodium spirale* sensu Smith. Union, *Smiths 6!.*

This species was collected by Joseph Dalton and has been cited under his name in several publications.

DESMODIUM TORTUOSUM DC. Isle of Ronde, *Howard 10756;* Bequia, *Smiths 277!;* Mustique, *Smith 99.*

A scandent herbaceous plant with branches to fifteen feet long. The plant was common in one small location on the Isle of Ronde. Many specimens of this plant, unbrowsed, were leafless but in complete and full flower. Other specimens had only mature fruits in leafless condition. The few specimens in leaf in March had flowers and all stages of fruit development.

DESMODIUM TRIFLORUM DC. Carriacou, *Howard 10872.*

A prostrate plant of coastal savannahs.

DOLICHOS LABLAB L. Bequia, *Smiths 251.*

ERYTHRINA EGGERSII Kruk. & Mold. Carriacou, *Howard 10958.*

This plant, previously reported only from Puerto Rico and the Virgin Islands, was cultivated as a fence row plant and apparently was of recent introduction.

ERYTHRINA VARIEGATA L. var. ORIENTALIS (L.) Merr. Carriacou, *Howard 10941.*

This plant is of Asiatic origin and is only rarely found under cultivation in the Antilles. Plants from which the cited specimens were obtained were growing in a row as a living fence. The flowers were a dirty white color only one or two flowers on the tree showing shades of salmon or orange color.

ERYTHRINA VELUTINA Willd. Carriacou, *Howard 10940.*

A plant of fence rows and cultivated as a shade tree in pastures.

GLIRICIDIA SEPIUM (Jacq.) Steud.

Specimens of this species were seen on Carriacou and Cannouan where the plants were used as living fence posts.

GALACTIA LONGIFLORA Arn. Cannouan, *Smiths 29.*

INDIGOFERA SUFFRUTICOSA Mill., *Indigofera Anil* sensu Smith. Carriacou, *Howard 10829;* Bequia, *Smith 264;* Mustique, *Smiths 100!.* Also seen on Union, Cannouan, Mayero and the Tobago Cays.

This species was in general cultivation in the Grenadines as a source of indigo around 1910. Currently the plant is abundant as a weed in cotton fields and is not used commercially.

LONCHOCARPUS BENTHAMIANUS Pittier, *Lonchocarpus violaceus* sensu Smith. Union, *Howard 10977;* Bequia, *Smiths 268;* Mustique, *Smiths 111.* Also seen on Carriacou and Cannouan.

This species does not do too well in the Grenadines although even there it is valued as a timber tree. The specimens seen were fifteen feet tall with short contorted trunks.

LONCHOCARPUS LATIFOLIUS (Willd.) H.B.K.

Beard reports this species occurring on Carriacou (Oxford For. Mem. **21:** 146. 1949).

PACHYRRHIZUS EROSUS (L.) Urb., *Pachyrhiza angulatus* sensu Smith. Bequia, *Smiths 255.*

PHASEOLUS LATHYROIDES L., *Phaseolus semierectus* sensu Smith. Bequia, *Smiths 257, 258;* Mustique, *Smiths 102.*

PISCIDIA PISCIPULA (L.) Sarg. Carriacou, *Howard 10860.*

A common tree of open dry woodlands on Carriacou. Specimens seen were thirty feet tall. In March the trees were beginning to flower.

RHYNCHOSIA MINIMA DC. Union, *Smiths 5;* Bequia, *Smiths 260;* Mustique, *Smiths 92!.* Also seen on Carriacou.

SOPHORA TOMENTOSA L. Union, *Howard 10993, Smiths 12!.*

A woody herb or shrub to four feet tall found only at the inland edges of mangrove swamps.

SWARTZIA SIMPLEX (Sw.) Spreng., *Swartzia grandiflora* Willd. Carriacou, *J. Beard 549, P. Beard 1213;* Bequia, *Smiths 119.*

A nine foot shrub with showy yellow flowers appearing in September.

STYLOSANTHES HAMATA (L.) Taub., *Stylosanthes procumbens* sensu Smith. Carriacou, *Howard 10850;* Bequia, *Smiths 242.*

A prostrate herb with yellow flowers streaked with red.

TERAMNUS LABIALIS Spreng. Bequia, *Smiths 259.*

VIGNA LUTEOLA Benth. Bequia, *Smiths 16.*

OXALIDACEAE

OXALIS FRUTESCENS L. Bequia, *Howard 11237.*

A yellow flowered herb to two feet tall growing in the dry shrub thickets on the crest of the south ridge of Bequia.

ERYTHROXYLACEAE

ERYTHROXYLUM OVATUM Cav., *Erythroxylum obtusum* sensu Smith. Carriacou, *Howard 10858;* Bequia, *Smiths 50, 85;* Mustique, *Smiths 120.*

These plants varied from shrubs of three feet which were much gnarled and stunted by the prevailing winds to trees twelve feet tall. They were relatively abundant on the windward coasts and were generally in open woodlands. The fruits were of full size but green in March.

ERYTHROXYLUM SQUAMATUM Sw.

Beard (Oxford For. Mem. **21:** 147. 1949) lists this species as a component of the forest reserve on Carriacou. I have seen no specimens which could be referred to this species.

ZYGOPHYLLACEAE

KALLSTROEMIA CARIBAEA Rydb., *Tribulus maxima* sensu Smith. Cannouan, *Howard 11096;* Mustique, *Smith 29;* Bequia, *Smiths 240, 271.* Also seen on the Isle of Ronde and on Union.

A roadside weed with prostrate branches and yellow flowers. Urban (Symb. Antill. **8:** 319. 1920) cites this species as occurring on Mustique. It seems probable that this reference is to the Smiths' specimen although Urban usually mentioned the Kew Bulletin reference when referring to the Smiths' collections. I have not seen the Smiths' specimens cited above.

RUTACEAE

AMYRIS ELEMIFERA L., *Amyris maritima* sensu Smith. Carriacou, *Howard 10819;* Petit St. Vincent, *Howard 10903;* Bequia, *Smiths 149, 150.* Also seen on Union and Cannouan.

A twelve to fifteen foot tree with blue-black fruits commonly found in the coastal thickets.

CITRUS AURANTIFOLIA (Christm.) Swingle.

The lime, usually called "lime leaf plant," was formerly cultivated on Carriacou. Occasional plants were found on almost every inhabited island where the leaves are considered to be the most important part of the plant. Lime leaves are used to make a nutritional tea or a tonic for both adults and children and a poultice of the leaves is reported to be beneficial "when things are moving inside." The fruits are not used by the natives and in some islands are actually considered harmful to the system.

MURRAYA EXOTICA L. Bequia, *Smiths 80.*

TRIPHASIA TRIFOLIA (Burm. f.) P. Wils., *Triphasia trifoliata* sensu Smith. Carriacou, *Howard 10867;* Mustique, *Smiths 143.*

A single plant, remanent of former cultivation, was found on Carriacou near an old ruins. The plant had grown to a height of eight feet and was probably fifteen feet in diameter and was densely branched to the ground. The red fruits of this shrub were collected by the people living nearby to make a medicinal tea said to be a "spring tonic."

SIMARUBACEAE

SURIANA MARITIMA L. White Island, *Howard 10974;* Union, *Smiths 17!;* Bequia, *Smiths 5, 104;* Mustique, *Smiths 153.*

A much branched shrub with prostrate to ascending branches reaching a height of eight feet. The flowers are yellow. In spite of the numerous collections made by the Smiths I saw this plant in 1950 only on the sandy spit running north from the rock pinnacle on White Island. *Suriana maritima* is much more abundant in the Greater Antilles than in the Lesser Antilles.

BURSERACEAE

BURSERA SIMARUBA L., *Bursera gummifera* sensu Smith. Bequia, *Smiths 143, 147, 330;* Mustique, *Smiths 142, 159.* Also seen on Carriacou, Union, Tobago Cays, Mayero and Cannouan.

This species is a conspicuous element of dry woodlands and is found quite commonly on the leeward sides of the islands of the Grenadines. The tree is known locally as the "turpentine tree." Its smooth or thin-peeling red-brown bark is distinctive but the wood is worthless, not even being cut for firewood in the Grenadines.

MELIACEAE

SWIETENIA MAHAGONI (L.) Jacq.

Specimens of the mahogany were seen on Carriacou and Union. One seed tree existed at the crest of the ridge southwest of Hillsborough on Carriacou. The old fields on the slopes below this tree were thick with seedling trees of the mahogany. The seedlings varied in height from two feet to seven feet. If the seedlings were properly thinned it appears the species will do well on those dry hillsides.

Beard in discussing the vegetation of Carriacou (Oxford For. Mem. **21:** 146. 1949) described "a tall woodland about 60 feet high of almost pure mahogany which is evidently a pioneer community on old agricultural land." While I followed the transect made by Beard I could not find the implied quantity of mahogany he describes. Certainly there is not a marketable quantity of this tree in the forest reserve on Carriacou today.

TRICHILIA HIRTA L. Carriacou, *Howard 10802, P. Beard 1200!, 1206!.*

Scattered trees each about fifteen feet tall were found on the dry open wooded hillslopes throughout Carriacou. The mature fruit was red in color in March.

MALPIGHIACEAE

BYRSONIMA SPICATA (Cav.) L. C. Rich.

Beard (Carib. For. **5:** 57. 1944) reports the existence of a previously published record of this species from the Grenadines. I have not located that reference and have seen no specimens which could be referred to this species.

BUNCHOSIA GLANDULOSA Rich. Bequia, *Smiths 145;* Mustique, *Smiths 119.*

I have not seen the Smiths' collections cited above. Niedenzu does not cite them in his treatment of the *Malpighiaceae* in Das Pflanzenreich. *Bunchosia glandulosa* is not common in the Lesser Antilles and it is probable that these two collections represent the following species.

BUNCHOSIA NITIDA (Jacq.) DC. Carriacou, *Howard 10809, 10854;* Bequia, *Howard 11248, Eggers 7072.* Also seen on Union and Cannouan.

This low shrub to small tree, five to twelve feet tall, is known locally as "chinkwood." The plants were distinctive in the field with soft gray-green drooping leaves. The petals and calyx glands of the flowers were bright yellow or golden in color. The mature fruits were slightly compressed and red or red-orange in color.

HETEROPTERIS PURPUREUS (L.) H.B.K. Isle of Ronde, *Howard 10765;* Cannouan, *Howard 11060;* Bequia, *Smiths 83, 283;* Mustique, *Smiths 37.*

An abundant woody vine often covering the tops of large areas of shrub land. The flowers were pink or lavender in color and the mature fruit reddish in hue.

MALPIGHIA COCCIGERA L. Bequia, *Howard 11238.*

This plant was a prostrate shrub less than one foot high and was found only on the ridge of the dry hills south of Port Elizabeth. It was abundant in that one small area. The flowers were pink.

MALPIGHIA PUNICIFOLIA L. Isle of Ronde, *Howard 10746;* Carriacou, *Howard 10843;* Bequia, *Smiths 77, Eggers 7072.* Also seen on Cannouan.

The Eggers collection was cited by Niedenzu in his treatment of the family for Das Pflanzenreich under *Bunchosia nitida* as well as *Malpighia punicifolia.* I have not seen Eggers' collection but assume it is a mixture.

Malpighia punicifolia was an inconspicuous component of the thorn shrub on Carriacou. On the Isle of Ronde only two trees about fifteen feet tall were seen, and both of these occurred in open areas on the wind-swept eastern slopes. Inhabitants of the Isle of Ronde regularly gathered fruits from these two trees and they were eaten raw or stewed. The fruit is known locally as "cherry."

MALPIGHIA URENS L. Bequia, *Smiths 144.*

POLYGALACEAE

SECURIDACA LAMARCKII Griseb. Bequia, *Smiths 276.*

This plant is called the "Easter Vine" throughout the Lesser Antilles. A few vines were seen in the most inaccessible places on the north coast of Bequia in full handsome flower at the end of March.

EUPHORBIACEAE

ACALYPHA CUSPIDATA Jacq. Cannouan, *Howard 11087;* Bequia, *Smiths 96.*

The Cannouan specimen was made from a six foot shrub with green inflorescences which was a common part of the shrub thickets.

ACALYPHA POIRETII Spreng. Carriacou, *Howard 10938.*

A small herb growing on rock outcrops in the woodland areas.

ACALYPHA WILKESIANA Muell-Arg.

A commonly cultivated ornamental bush known in the Lesser Antilles as the "headache bush." Specimens were seen on Bequia. The leaves are used as a poultice to cure a headache and occasionally a tea made from the leaves is used for the same purpose.

BERNARDIA CORENSIS (Jacq.) Muell-Arg. Petit Martinique, *Howard 10934;* Mayero, *Howard 11048;* Bequia, *Smiths 196.* Also seen on Union and the Tobago Cays.

A two to three foot bush generally found on rocky outcrops. The leaves are characteristically dark green and glossy.

BERNARDIA DICHOTOMA (Willd.) Muell-Arg. Carriacou, *Howard 10889;* Bequia, *Howard 11253.*

A bush, nine to twelve feet tall, growing on the ridges in shrub thickets.

CNIDOSCOLUS URENS (L.) Arthur, *Jatropha urens* sensu Smith. Bequia, *Smiths 102;* Mustique, *Smiths 10.* Also seen on Carriacou, Union, Cannouan, and the Tobago Cays.

One becomes familiar with this plant very early in the course of field work in the Grenadines. The plant is well named the "devil nettle" for I know of no other plant in the area so painful to contact. The plant is widely distributed through the Grenadines and fortunately the individuals are scattered, rarely more than two plants occurring together. On Large Island, south of Carriacou, however, old cultivated fields have grown up to solid stands of this plant. In open or exposed areas the plants are three to five feet tall although in rocky outcrops or piles of boulders the plant may be only one foot tall with the crown closely appressed to the surface of the surrounding rocks.

In thickets or shrub lands on such places as the Tobago Cays, or the northern coast of Bequia, the species becomes woody and one specimen twenty feet tall was found with a trunk diameter of ten inches at breast height.

The entire plant is covered with stout stinging hairs. The distribution of the hairs on the leaves varies in density from one plant to another, some leaves being almost white with this peculiar pubescence. The inflorescence is attractive when in full flower with a creamy white perianth. If contact is made with this plant the results are extremely painful. The hairs usually penetrate deeply into the flesh and a general swelling of the limb may follow. Discoloration follows within a few days and the area around the puncture may turn black. Generally a small blister forms over the puncture. Following the reduction of the swelling the tissue of the limb seems to shrink, and a hole, frequently the size of the point of a pencil remains. For a few punctures the native treatment is the application of mudpacks but for serious encounter bed rest is essential in that shock symptoms may follow.

CROTON FLAVENS L., *Croton astroites* sensu Beard. Isle of Ronde, *Howard 10745;* Kick 'em Jenny, *Howard 10791;* Carriacou, *Howard 10812, P. Beard 1199!;* Union, *Smiths 16;* Cannouan, *Howard 11081, Smiths 9;* Bequia, *Smiths 94, 95!;* Mustique, *Smiths 138;* Balliceaux, *Howard 11287.*

This is perhaps the most abundant and widely distributed species of *Croton* found in the Grenadines. The plants dominate all abandoned areas of cultivation and are found in the mixed shrub thickets throughout the area. The plants are woody shrubs, two feet high in exposed places and reach the height of six feet in sheltered areas. On Balliceaux *Croton flavens* is associated with *Randia aculeata* in almost pure stands.

CROTON GUILDINGII Griseb. Bequia, *Smiths 91;* Mustique, *Smiths 136.*

CROTON HELICOIDES Muell-Arg., *Croton nivens* sensu Smith. Bequia, *Smiths 93!*.

The above cited specimen at the Gray Herbarium is referable to *Croton helicoides* although that species at the New York Botanical Garden has been considered synonymous with *C. bixoides* Vahl. and so annotated by Carabia.

CROTON NIVEUS Jacq. Carriacou, *Howard 10852;* Bequia, *Howard 11268, Smiths 92;* Balliceaux, *Howard 11288;* Mustique, *Howard 11224, Smiths 137!*.

This is the most attractive of the species of *Croton* found in the Grenadines. The shrubs reach a height of twelve feet and the brown or bronze leaves are silvery below and glisten when turned by the wind. The silvery surface is dotted with small brown glands and this color combination is also found on the inflorescence. The plant is particularly abundant on the north slope of the peninsula running south and west of Port Elizabeth on Bequia.

CROTON POPULIFOLIUS Sw. Cannouan, *Howard 11082;* Bequia, *Howard 11249, Smiths 88, 89, 90;* Mustique, *Smiths 139.*

This species was found in greatest abundance on the upper slopes of Mt. Royal on Cannouan. Plants varied from small trees of eight feet in height to twenty foot trees.

DITAXIS LANCIFOLIA Schl., *Argithamnia lancifolia* sensu Smith. Carriacou, *Howard 10811*; Cannouan, *Howard 11086;* Bequia, *Smiths 207.*

A two to four foot shrub with white flowers and green fruit found on dry open hillsides.

EUPHORBIA ARTICULATA Aubl. Bequia, *Howard 11269.*

A shrub or woody herb becoming four feet tall. The leaves are variable in shape and variegated green and white in color. This plant was found only on the rock outcrops at the ultimate end of the north ridge.

EUPHORBIA BUXIFOLIA Lam. White Island, *Howard 10973;* Union, *Smiths 27;* Bequia, *Smiths 105, 199;* Mustique, *Smiths 22, 23.* Also seen on Carriacou and Cannouan.

A small woody shrub of coastal rock outcrops. This is another example of a plant extremely abundant in the Greater Antilles and very poorly represented in the islands of the Lesser Antilles.

EUPHORBIA COTINIFOLIA L. Bequia, *Howard 11254.*

This low shrub is limited to the few moist ravines on the north coast of Bequia. The bracts of the flowers are white.

EUPHORBIA HIRTA L. Carriacou, *Howard 10848.*

A roadside weed, relatively abundant and conspicuous because of the red tinge to the leaves. The plant is called "checkweed" and a tea from the leaves is used in the Grenadines in the treatment of diarrhoea.

EUPHORBIA PROSTRATA Ait. Bequia, *Smiths 202;* Mustique, *Smiths 32.*

EUPHORBIA PILULIFERA L., *Euphorbia hypericifolia* sensu Smith. Carriacou, *Howard 10879;* Bequia, *Smiths 197, 198;* Mustique, *Smiths 12, 12A.*

I have not seen the Smiths' collections cited above and can only use the currently accepted nomenclature for this species, where *E. hypericifolia* is considered synonymous with *E. pilulifera*. The Smiths' collections were considered distinct in the original list published in Kew Bulletin.

My collection from Carriacou was made in a grassy coastal savannah. EUPHORBIA SERPENS H.B.K. Carriacou, *Howard 10950;* Cannouan, *Howard 11113.* Also seen on Union, the Tobago Cays, Mayero and Bequia.

A prostrate plant found at the edges of mangrove swamps or less frequently on coastal rocks. The plant is called "checkweed" locally and is used in the treatment of diarrhoea.

HIPPOMANE MANCHINELLA L. Mayero, *Howard 11039;* Bequia, *Smiths 142;* Mustique, *Smiths 125.* Also seen on Carriacou, the Tobago Cays. Petit Martinique, Petit St. Vincent, Union and Cannouan.

The manchineel is a common and dangerous tree of sandy or coral beaches of the Lesser Antilles and is occasionally found inland in dry open woodlands in the Grenadines. The plants are usually found on the leeward coasts in protected areas as they do not seem to stand salt spray or prevailing winds. The trees reach a height of twenty feet in the Grenadines and have a graceful symmetrical crown and a pleasing appearance. The male flowers are bright yellow in color and the female flowers a dull green.

The fruits of this tree litter the beaches throughout the Grenadines and are dangerous fruits. They must not be eaten even though their resemblance in color, shape and odor to small green or yellow crab apples makes them attractive. Serious nausea and diarrhoea are usually followed by shock and an appalling muscular weakness. Sloughing off of mucus membranes occurs within a day or two if even a small quantity of the fruit is eaten. The juice of the tree or the fruit in the eye will cause violent conjunctivitis and usually temporary blindness. Arrowroot is considered the best antidote for this poison in the Grenadines. A suspension of arrowroot starch is given in liberal doses when the fruit has been eaten and poultices of arrowroot starch are applied to external burns from the juice of the manchineel.

HURA CREPITANS L. Bequia, *Smiths 114.*

JATROPHA CURCAS L. Bequia, *Smiths* without number; Mustique, *Smiths 135!.* Also seen on Carriacou and Union.

The plant was used as a fence row plant or living fence post on the island of Carriacou. Occasional plants were found on the other islands mentioned. The laxative properties of this fruit are well known in the Grenadines and the leaves, rarely the fruit, are used medicinally for that purpose. The common name of the plant is "physic nut."

JATROPHA GOSSYPIFOLIA L. Bequia, *Smiths 101, 103;* Mustique, *Smiths 11.* Also seen on Petit Martinique and Union.
PHYLLANTHUS ANTILLANUS (Juss.) Muell-Arg., *Phyllanthus nobilis* sensu Smith. Mustique, *Smiths 128!.*
PHYLLANTHUS NIRURI L. Carriacou, *Howard 10871.* Also seen on Bequia.

This small herb is called "seed under leaf" or "chic-weed" and a tea of the leaves is used in the treatment of malaria and other fevers but not typhoid fever. The Carriacou specimen was found on the coastal savannah.

PEDILANTHUS TITHYMALOIDES Poit. Isle of Ronde, *Howard 10720;* Union, *Howard 11003, Smiths 122;* Cannouan, *Howard 11076.* Also seen on Carriacou and Bequia.

Occasional specimens of this plant were seen on the Isle of Ronde and Union where they grew in the *Opuntia* thickets or on rocky outcrops. These plants were less than three feet tall. On Cannouan, however, this was a very common plant in the dry woodlands on the slopes of Mt. Royal. Here the plants reached ten feet in height. The "flowers" were usually red and yellow although occasionally pure red stands were observed. The leaves are succulent when fresh and commonly a bright red color.

RICINUS COMMUNIS L. Bequia, *Smiths 98.* Also seen on Carriacou, Union and Cannouan.

This species is now grown only as an ornamental although at some time in the past the plant was grown on a commercial scale on Carriacou.
TRAGIA VOLUBILIS L. Isle of Ronde, *Howard 10735;* Carriacou, *Howard 10857;* Union, *Smiths 32;* Bequia, *Smiths 173!;* Mustique, *Smiths 44.* Also seen on Cannouan.

This herbaceous vine of dry woodlands has attractive red flowers and fruits and foliage with a silvery pubescence. It is deceptive, however, being one of the stinging plants of the area, called locally "stinging nettle." The hairs of the plant, on contact, cause a dermatitic urticaria. *Tragia* is not the menace of *Cnidoscolus* and the pain from contact with this plant rarely lasts more than a few hours even in the worst cases.

A tea is made of the leaves of this plant and is used medicinally for blocked micturition or cases when urination is difficult.

ANACARDIACEAE

COMOCLADIA DODONAEA (L.) Urb., *Comocladia ilicifolia* sensu Smith. Carriacou, *Howard 10817;* Union, *Howard 10975;* Bequia, *Smiths 71;* Mustique, *Smiths 126.* Also seen on Cannouan.

The Union Island specimens cited above were part of a pure stand of *Comocladia Dodonaea* growing near the summit of The

Pinnacle. The plants were about ten feet tall and were four to six inches in diameter at breast height. All other specimens seen in the Grenadines were growing as occasional components of the shrub woodlands. The flowers are a deep red color when fresh and generally appear with the flush of new leaves following the dry season. The local name for this plant is "brazil" and the poisonous quality of the plant is well known.

SPONDIAS MOMBIN L., *Spondias lutea* sensu Smith. Bequia, *Smiths 124;* Mustique, *Smiths 160.*

The fruits of this ugly shaped tree are called "hog plums" on all islands of the Grenadines except Bequia where it is known as the "Bequia plum." The specimens seen on Bequia represent a clone of especially good flavored fruits. Preserves made of the fruits from Bequia are well known throughout the southern islands of the Lesser Antilles. Elsewhere in the Grenadines the fruits of the hog plum have the usual unpalatable flavor.

CELASTRACEAE

ELAEODENDRON XYLOCARPUM DC. var. CARIBAEUM Urb., *Elaeodendron dioicum* sensu Smith. Bequia, *Smiths 125, 126.*

I have not seen these specimens collected by the Smiths but Urban cited them in his treatment of this species in Symbolae Antillanae (5: 90. 1904).

MAYTENUS ELLIPTICA Krug & Urb., *Maytenus* sp. sensu Smith. Petit St. Vincent, *Howard 10897;* Cannouan, *Howard 11069, 11088, 11089, 11101;* Bequia, *Howard 11267, Smiths 62!.*

This species is one of the most common low trees in the dry open woodlands and shrub thickets of the Grenadines. The plants are extremely variable in appearance due to the color and glossiness of the leaves. The trees are fifteen to twenty feet tall and were found in flower and fruit in March. The flowers are green and the mature fruit a bright orange color.

SCHAEFFERIA FRUTESCENS Jacq. Carriacou, *Howar d10800;* Petit Martinique, *Howard 10923.*

This species is a five to eight foot shrub in the Grenadines and is distinctive in the field in the shade of green of the thick leaves and the young stems.

SAPINDACEAE

CARDIOSPERMUM CORINDUM L. Union, *Howard 11014.* Also seen on Cannouan.

A vine with white flowers and greenish-yellow fruits tinged with red.

CARDIOSPERMUM MICROCARPUM H.B.K. Mayero, *Howard 11055;* Bequia, *Smiths 313.*

A low herbaceous plant with white flowers and blue-black seeds.

DODONAEA VISCOSA L. Bequia, *Smiths 129*.

This species is a common element of the seacoast shrub vegetation in the Greater Antilles. I did not see any material of *Dodonaea viscosa* in my collecting in the Grenadines.

SAPINDUS SAPONARIA L. Cannouan, *Howard 11107*.

A single tree of this species on Cannouan was twelve feet tall and was growing in formerly cultivated fields. It may be a remanent of former cultivation.

URVILLEA ULMACEA Kunth., *Urvillea seriana* sensu Smith. Bequia, *Eggers, 7043;* Mustique, *Smiths 33!*.

The collection by the Smiths in the Gray Herbarium bears the number G-33; however, this collection is cited as *Smith 93* in the Kew Bulletin (243. 1893) and by Radlkofer in Das Pflanzenreich IV, 165: 361. 1932.

RHAMNACEAE

COLUBRINA RECLINATA Brongn.

Dr. Nichols reports in his diary that this plant occurs on Union Island and that the bark is used by the natives as a tonic or laxative. He adds, however, that the tree has become very rare because of demands on the supply and that in 1891 the bark was being imported because of the depletion of the local source. No specimens of this plant were seen in the Grenadines during my collecting there in 1950.

GOUANIA LUPULOIDES (L.) Urb., *Gouania domingensis* sensu Smith. Carriacou, *Howard 10855;* Bequia, *Smiths 38*. Also seen on Cannouan.

A woody vine climbing over the tops of shrubs in thickets.

KRUGIODENDRON FERREUM (Vahl.) Urb. Bequia, *Howard 11244*.

A few bushes, twelve feet in height, were found on dry open hillsides.

VITACEAE

CISSUS SICYOIDES L., *Vitis sicyoides* sensu Smith. Kick 'em Jenny, *Howard 10794;* Cannouan, *Howard 11105;* Bequia, *Smiths 313;* Mustique, *Smiths 45!*.

A succulent leafed vine along the seacoasts but occurring only at the summit of Kick 'em Jenny. The mature fruit is black.

TILIACEAE

CARPODIPTERA FLORIBUNDA Urb. Carriacou, *Howard 10964, P. Beard 1208!*.

A thirty foot tree on a dry hillside. The winged fruits are tan in color when shed.

CORCHORUS AESTUANS L., *Corchorus acutangulus* sensu Smith. Isle of Ronde, *Howard 10743;* Cannouan, *Howard 11092,* Bequia, *Smiths 168;* Mustique, *Smiths 8*.

A woody herb usually growing in *Opuntia* stands. The flowers are yellow and the fruit reddish.
CORCHORUS HIRTUS L. Union, *Howard 10986;* Bequia, *Smiths 165, 170.*
CORCHORUS SILIQUOSUS L. Bequia, *Smiths 169;* Mustique, *Smiths 9.*
TRIUMFETTA LAPPULA L. Bequia, *Smiths 154!* in part.
TRIUMFETTA SEMITRILOBA L. Bequia, *Smiths 154!* in part.

MALVACEAE

ABUTILON CRISPUM (L.) Medic. Union, *Howard 10978;* Bequia, *Smiths 8;* Mustique, *Smiths 72!.* Also seen on Cannouan.

An herb with long trailing branches. The flowers were bright yellow and the fruits green and tan. The plant was found only at coastal elevations usually in grasslands or pasture areas.
ABUTILON HIRTUM (Lam.) Sweet, *Abutilon indicum* sensu Smith. Bequia, *Smiths 156.*
ABUTILON UMBELLATUM (L.) Sweet. Carriacou, *Howard 10827;* Petit Martinique, *Howard 10921;* Union, *Powell 88;* Cannouan, *Howard 11103;* Bequia, *Smiths 157, 166;* Mustique, *Smiths 71.*

A woody herb reaching seven feet in height with yellow or yellow-orange flowers.
HIBISCUS TILIACEUS L. Union, *Howard 10995;* Bequia, *Smiths 161.*

A shrub of swampy areas with semi-prostrate ascending branches often ten feet long. The flowers are yellow at first turning red or orange in age.
MALACHRA ALCEIFOLIA Jacq. Mayero, *Howard 11037.*

A five foot woody herb or shrub with yellow flowers. This stout weed dominates the cotton fields on Mayero dwarfing the poor crop of sea island cotton.
MALACHRA CAPITATA L. Carriacou, *Howard 10869;* Mustique, *Smiths 73.* Also seen on Union and Cannouan.

A common weed of old cotton fields now established on the coastal rocks. Plants exposed to the salt spray are almost prostrate but those of old fields may reach a height of two feet. The flowers are yellow.
MALVASTRUM CORCHORIFOLIUM (Desv.) Britton, *Malvastrum tricuspidata* sensu Smith. Isle of Ronde, *Howard 10722;* Union, *Smiths 29, Powell 92;* Bequia, *Smiths 164.*
MALVASTRUM SPICATUM (L.) Gray. Union, *Howard 11017;* Bequia, *Smiths 214.*

Both species of *Malvastrum* are weeds of pastures or old cultivated fields. The plants are stout herbs reaching a height of three feet and have yellow-orange flowers.
SIDA ACUTA Burm., *Sida carpinifolia* sensu Smith. Carriacou, *Howard 10946;* Union, *Smiths 33, 34;* Bequia, *Smiths 162, 163;* Mustique, *Smiths 75!*
SIDA CILIARIS L. Bequia, *Smiths 171.*
SIDA CORDIFOLIA L. Bequia, *Smiths 159.* Also seen on Cannouan.

The herb has two common names on Bequia, "man better man" and "verveint potter bush." A hot tea brewed from the leaves of this plant

is used in treating marasmus and amenorrhea and the common name seems to depend on the intended use.

SIDA GLOMERATA Cav. Cannouan, *Howard 11064*, *Smiths 13*. Also seen on Mayero.

A three to four foot herb with whitish flowers growing in dry open woodlands usually on ridges.

SIDA MACULATA Cav. Union, *Howard 10989*.

A roadside weed to eighteen inches tall. The flowers are red-brown at the center and orange on the margins.

SIDA SPINOSA L. Carriacou, *Howard 10868*.

A prostrate yellow-flowered plant of the seacoast savannahs on the windward slopes.

THESPESIA POPULNEA Soland in Correa. Bequia, *Smiths 160!*.

This is a common woody plant on Bequia, used as a living fence post and kept trimmed. The local explanation of the common name of "John Bull" was that the plant "will take root anywhere." I cited this specimen as collected by Joseph in a treatment of the genus in Bull. Torrey Bot. Club **76:** 95. 1949.

WISSADULA AMPLISSIMA (L.) Fries, *Wissadula rostrata* sensu Smith. Cannouan, *Smiths 16*.

WISSADULA PERIPLOCIFOLIA (L.) Presl. Union, *Howard 10987*.

BOMBACACEAE

ADANSONIA DIGITATA L.

Dr. Nichols reports in his diary of his visit to Mustique in 1891. He commented "close by a pond on the flat below the great house is a fine large Baobob. *Adansonia digitata* was growing luxuriantly and it must have been brought to the island many years ago." I did not see Dr. Nichols' diary until I completed my work in the Grenadines but I did see and wonder about the specimen of *Adansonia* still growing by the pond. The tree appears to be healthy and is probably the oldest tree on the island.

CEIBA PENTANDRA (L.) Gaertn. Specimens were seen on Cannouan and Bequia.

Several specimens of the silk cotton tree were found on Cannouan now growing in dense wooded lands. However, near each tree one finds old ruins or evidence of earlier habitations and probably all the specimens were cultivated at one time. It is also interesting to note that one of the original boundary markers of the town of Port Elizabeth on Bequia was a silk cotton tree. The other marker was a locust and both trees are still standing.

STERCULIACEAE

GUAZUMA ULMIFOLIA Lam. Bequia, *Smiths 36, 37*. Also seen on Carriacou.

An occasional tree in the dry woodlands, usually on the leeward side.
MELOCHIA NODIFLORA Sw. Cannouan, *Howard 11057;* Mustique, *Smiths 70.*
MELOCHIA TOMENTOSA L. Mayero, *Howard 11049;* Union, *Smiths 30;* Cannouan, *Smiths 19, P. Beard 1409!;* Bequia, *Smiths 167;* Mustique, *Smiths 85, 86!.* Also seen on Carriacou and the Tobago Cays.

A very abundant woody shrub of formerly cultivated fields. The plants reach three feet in height and the flowers vary from lavender to rose. The local name for this species is "balsam."
WALTHERIA AMERICANA L. Bequia, *Howard 11275, Smiths 158.*

A three foot yellow flowered woody herb of old cultivated fields. The plant is known locally as "leather coat" or "buff coat" and a tea of the leaves is used medicinally for "increasing the blood."

GUTTIFERAE

CALOPHYLLUM BRASILIENSE Camb. var. ANTILLANUM (Britt.) Standley, *Calophyllum Calaba* sensu Smith. Bequia, *Smiths 39.*
CLUSIA MINOR L. Bequia, *Howard 11246.*

Clusia is another genus well represented in the Greater Antilles that was conspicuous by its absence in the Grenadines. A single specimen, a weak sprawling or partially climbing tree with green fruit was found in a ravine on the dry hills south of Port Elizabeth.
Clusia sp. Bequia, *Smiths 121*, and without number.

The Smiths' collections mentioned in the Kew Bulletin were not found in any of the American herbaria studied.

FLACOURTIACEAE

CASEARIA BONAIRENSIS Bold. Isle of Ronde, *Howard 10762;* Petit St. Vincent, *Howard 10906.*

A shrub five to six feet tall with creamy white flowers and characteristically drooping leaves. The species has been previously known from Curacao, Aruba, Bonaire and northern Venezuela. This is the first record of its occurrence in the Antilles.
CASEARIA DECANDRA Jacq. Union, *Howard 10996.* Also seen on Carriacou, Tobago Cays and Cannouan.

Known locally as "Jumbie apple" these are eight foot shrubs with white flowers and reddish-orange fruits which are said to be edible.
CASEARIA GUIANENSIS (Aubl.) Urb. Beard (1949, p. 146) reports this species on Carriacou. I have seen no material from the Grenadines.
FLACOURTIA CATAPHRACTA Roxb. Mustique, *Smiths 121, 148.*

PASSIFLORACEAE

PASSIFLORA FOETIDA L. var. HISPIDA (DC) Killip, *Passiflora foetida* sensu Smith. Cannouan, *Howard 11058;* Bequia, *Smiths 310.*

An herbaceous vine with conspicuous green bracts subtending the flowers. The perianth was white and the corona purple. A plant of dry woodlands.

PASSIFLORA LAURIFOLIA L. Union, *Howard 11004;* Bequia, *Smiths 132;* Mustique, *Smiths 42!.*

An herbaceous vine growing over the tops of shrubs at higher elevations. The flowers are blue-purple and white. Locally the plant is known as the "bell apple."

As mentioned earlier in the discussion of the Smiths' collections some of the collection numbers are prefixed with a letter. The label on the Mustique specimen bears the number G-42. Killip in his monograph of the *Passifloraceae* (Field Mus. Nat. Hist. Bot. Series **19:** 366. 1938) erronously cites this Smiths' specimen as "Smith 942 from Martinique."

PASSIFLORA SUBEROSA L. Isle of Ronde, *Howard 10777;* Kick 'em Jenny, *Howard 10790;* Carriacou, *Howard 10859;* Cannouan, *Howard 11111;* Bequia, *Smiths 315, 316, Howard 11266;* Mustique, *Smiths 41.*

An herbaceous vine crawling on the ground, rocks or ascending to the tops of the shrub growth. The fleshy leaves are variable in color, amount of lobing and thickness. The flowers are cream to yellow in color and the mature fruit is a deep red color. The plant is known by the common name of "threft leaf" and a tea made from the leaves is used for treatment of dysmenorrhea.

CARICACEAE

CARICA PAPAYA L. Bequia, *Smiths 97.*

This plant, the papaya, is in general cultivation on all the inhabited islands of the Grenadines and was found persisting after cultivation on White Island and on the Tobago Cays. The residual plants produce small and dry fruits with little flavor to the pulp. Generally in the Grenadines the leaves are stewed as greens and the plant is highly regarded as an attractive ornamental for its deeply cut foliage.

BEGONIACEAE

BEGONIA sp. Bequia, *Smiths 11.*

This collection by the Smiths is listed in the Kew Bulletin but specimens are not available in American herbaria. I suspect it may be a cultivated species or one escaped from cultivation. Certainly no area on Bequia today is of a nature in which one would expect to find *Begonia* growing as a native.

CACTACEAE

CACTUS BROADWAYI Britt. & Rose. Isle of Ronde, *Howard 10711.* Also seen on Carriacou, Union, the Tobago Cays, Cannouan and Bequia.

This species differs from the more widely distributed *C. intortus* only in its curved spines. *C. Broadwayi* is well represented in the Grenadines with these cushion cacti abundant in rocky areas usually on the windward sides of the islands. The flowers and fruits are pink and the small fruits are relished by the natives.

CEPHALOCEREUS NOBILIS (Haw.) Britt. & Rose. Carriacou, *Howard 10892*. Also seen on Union, the Tobago Cays, Cannouan and Bequia.

A cylindrical cactus of infrequent occurrence. The flowers are cream colored and the fruit while green in appearance is deep red in color inside.

HYLOCEREUS TRIGONUS (Haw.) Safford.

This is by far the most abundant cactus in dry open woodlands in the Grenadines. It is a climbing arching cactus with four angled stems and was not found in flower or fruit in March. *H. trigonus* was seen on all the islands visited and was most abundant on Carriacou, Cannouan and Bequia.

OPUNTIA DILLENII (Ker-Gaw.) Haw. Carriacou, *Howard 10891*. Also seen on Union, the Tobago Cays, Mayero, Cannouan and Bequia.

Opuntia Dillenii is a common plant on the windward rocky slopes of the islands of the Grenadines. The plants occur in dense stands and reach a height of four feet. The stems apparently rot out at the base and the mass collapses to make an extremely difficult tangle to penetrate. Generally speaking this cactus barrier exists between the windswept shrub zone and the prostrate fleshy herb region immediately along the coast on the windward slopes. The flowers are reddish-yellow in color and the natives report that fruit rarely develops on these plants.

PERESKIA ACULEATA Mill. Bequia, *Smiths* without number.

The Smiths' collection has not been seen by recent workers on the *Cactaceae*. *P. aculeata* is reported from Trinidad and Martinique in the southern Lesser Antilles but its occurrence in Bequia is a bit unusual. It may have been a cultivated plant.

THYMELÆACEAE

DAPHNOPSIS CARIBAEA Griseb.

John Beard reports this small tree in the forest reserve on Carriacou (Oxford For. Mem. **21:** 146. 1949). I have seen no specimens of this species from the Grenadines.

RHIZOPHORACEAE

RHIZOPHORA MANGLE L.

The red mangrove was seen on Carriacou, Union, the Tobago Cays, Bequia and Mustique. However, no extensive swamps were observed and generally only a mere fringe of *Rhizophora* exists along the shore lines in limited areas.

The oysters which grow on the roots of *Rhizophora* are especially famous in Carriacou. Numerous stories of the Lesser Antilles describe these small oysters. One of the latest reports is that of Mitchell (Nat. Geographic Mag. **93:** 5, pl. 13. 1948).

COMBRETACEAE

CONOCARPUS ERECTUS L. Union, *Smiths 18;* Bequia, *Smiths 66, 67!*. Also seen on Carriacou, the Tobago Cays, Mayero and Cannouan.

This species is of infrequent occurrence in the Grenadines. Specimens seen in the field were growing on limestone outcrops along the coast and were invariably stunted.

LAGUNCULARIA RACEMOSA (L.) Gaertn. Cannouan, *Smiths 3;* Mustique, *Smiths 132;* Bequia, *Smiths 64, 84.* Also seen on Union.

An infrequent tree of inland swamps occurring occasionally in old salt ponds.

TERMINALIA LATIFOLIA Sw. Bequia, *Smiths 127.*

I did not see any specimens of this species in the Grenadines in 1950. The tree was widely planted fifty years ago as it occurs in rows and plantations on some of the other islands of the Lesser Antilles.

TERMINALIA CATAPPA L.

Locally known as "almond," *T. Catappa* is planted near houses for shade on Carriacou, Union and Bequia.

MYRTACEAE

EUGENIA AXILLARIS (Sw.) Willd.

This species is listed from the Grenadines but without specific locality by Beard (Carib. For. **5**: 61. 1944). I have seen no material from the Grenadines which could be referred here.

EUGENIA CORDATA (Sw.) P. DC. var. SINTENISII (Kiaersk.) Krug & Urb., *Eugenia* sp. sensu Smith. Cannouan, *Howard 11080;* Bequia, *Howard 11243, Smiths 133, 145.*

This is a relatively common shrub or small tree of the dry open woodlands. The plants reach fifteen feet in height and the mature fruits are a bright red in color. The leaves are dark green except for a characteristically white or translucent midrib. The Smiths' collections were cited by Urban.

EUGENIA MONTICOLA (Sw.) P. DC. var. LATIFOLIA (P. DC.) Krug & Urb., *Eugenia baruensis* sensu Smith. Carriacou, *J. Beard 545!, P. Beard 1207!;* Cannouan, *Howard 11067;* Bequia, *Smiths 72!.*

EUGENIA LIGUSTRINA Willd. Petit St. Vincent, *Howard 10904;* Cannouan, *Howard 11066;* Bequia, *Howard 11258, Smiths 82!.*

A characteristic element of open woodlands. The shrubs are distinctive in having open flat branching with shiny dark green leaves.

MYRCIA CITRIFOLIA (Aubl.) Urb., *Myrcia coriacea* sensu Smith. Bequia, *Smiths 81!*

PIMENTA RACEMOSA (Mill.) J. Moore, *Amomis caryophyllata* Krug & Urb., *Pimenta acris* sensu Smith. Bequia, *Howard 11262, Smiths 15!.*

P. racemosa is a conspicuous tree of the northern part of Bequia. The plant is called "cinnamon" or "cinnamon bush" locally and is said to be introduced there to be cultivated for the cinnamon bark. The plants are spreading rapidly and the current trees average twenty feet in height with the largest specimen seen reaching forty feet in height. Young plants are very abundant. The leaves are used to make a tea for treating diarrhoea and are occasionally used for flavoring the freshly distilled rum.

PSIDIUM GUAJAVA L., *Psidium Guayava* sensu Smith. Bequia, *Smiths 68!*. Also seen under cultivation on Carriacou and Union.

The local name of this plant is "guava bush" and the leaves are used in a tea for the treatment of diarrhoea. The fruits produced by these plants in the Grenadines are small and inedible.

MELASTOMACEAE

MICONIA ELONGATA DC. Bequia, *Smiths 35*.

This is a South American species cited in the Kew Bulletin and by Beard (Carib. For. **5:** 62. 1944) as occurring in the Grenadines. I have not seen this specimen and it is possible that Beard's reference is based on the Smiths' collection.

MICONIA LAEVIGATA DC. Bequia, *Smiths 33, 34!*.

A relatively common plant on the southwest peninsula of Bequia occurring on dry hillsides.

ONAGRACEAE

JUSSIAEA SUFFRUTICOSA L. Bequia, *Smiths 178*.

THEOPHRASTACEAE

JACQUINIA BARBASCO (Loefl.) Mez., *Jacquinia armillaris* sensu Smith. Isle of Ronde, *Howard 10736;* Cannouan, *Smiths 6;* Mustique, *Smiths 146*. Also seen on Petit St. Vincent, Mayero and the Tobago Cays.

A twelve foot tree of the windswept eastern coast. The plants often appear trimmed and are also often contorted by the prevailing winds. The flowers are cream to white in color.

JACQUINIA REVOLUTA Jacq. Carriacou, *Howard 10838;* Bequia, *Howard 11271*.

A compact five foot bush to a small twelve foot tree of dry hillsides. The flowers are white and the fruit a red-orange color contrasting with the yellowish calyx when mature.

PLUMBAGINACEAE

PLUMBAGO SCANDENS L. Isle of Ronde, *Howard 10774;* Bequia, *Smiths 140*. Also seen on Carriacou, Union, Mayero and Cannouan.

A very common woody vine or small shrub with scandent branches found along roadsides and in old cultivated fields. The flowers are white.

SAPOTACEAE

ACHRAS SAPOTA L. Bequia, *Smiths 108!*

This specimen has been cited either as *Joseph Dalton 108* or *Smith 108* in recent work on the *Sapotaceae*.

BUMELIA BUXIFOLIA Willd.

This species is reported from the Grenadines by J. Beard (Carib. For. **5:** 63. 1944).

BUMELIA OBOVATA (Lam.) A. DC. Bequia, *Howard 11240*.

A spiny shrub or tree to twenty feet tall. The flowers are cream or white and fruit is green when mature.

DIPHOLIS SALICIFOLIA (L.) A. DC.

This species was mentioned by Beard in his description of the woodlands on both Carriacou and Cannouan (Oxford For. Mem. **21:** 146. 1949). I have not seen specimens referable to this species.

MASTICHODENDRON FOETIDISSIMUM (Jacq.) Cronq., *Sideroxylon foetidissimum* Jacq. Carriacou, *Howard 10821*, *P. Beard 1198*.

A twenty foot tree with a characteristic muscular gray-brown bark. The mature fruit is bright orange. The tree is known locally as "aroma."

EBENACEAE

DIOSPYROS INCONSTANS (Jacq.) Griseb. Isle of Ronde, *Howard 10716;* Tobago Cays, *Howard 11031;* Bequia, *Smiths 152*. Also seen on Carriacou.

Plants of this species vary from five foot bushes to fifteen foot trees. Throughout the area where specimens were seen the plants produced very heavy crops of fruit, the trees often appearing orange from the many fruits produced.

DIOSPYROS sp. Bequia, *Smiths 45*.

I have not seen the Smiths' collection listed in the Kew Bulletin.

OLEACEAE

FORESTIERA RHAMNIFOLIA Griseb. Petit St. Vincent, *Howard 10898*.

A fifteen foot tree growing on the rock pile forming the west end of the island. The fruit was blue-black in color and extremely abundant.

LINOCIERA CARIBAEA (Jacq.) Knobl., *Linociera compacta* sensu Smith. Bequia, *Howard 11242*, *Smiths 30*, *31*.

A bush or small tree, six to twenty feet tall. The mature fruit was green.

LOGANIACEAE

SPIGELIA ANTHELMIA L. Mayero, *Howard 11054;* Bequia, *Smiths 221;* Mustique, *Smiths 6*. Also seen on Carriacou, Union and Cannouan.

An occasional herb in old fields. In fruit in March, the fruits green in color.

GENTIANACEAE

ENICOSTEMA VERTICILLATUM (L.) Engl., *Enicostema littorale* sensu Smith. Carriacou, *Howard 10953;* Cannouan, *Howard 11063;* Bequia, *Howard 11239*, *Smiths 188*.

An herb to two feet tall, this white flowered plant was usually found growing in saline areas especially near mangrove swamps. The specimen from Cannouan, however, was growing in dry open woodland on coral rock near the summit of Mt. Royal. The plant is known locally as "part of man's life" and a tea made from the leaves is used in the treatment of colds and all fevers except typhoid.

APOCYNACEAE

LOCHNERA ROSEA (L.) Reichenb., *Vinca rosea* sensu Smith. Bequia, *Smiths 195*. Also seen on Carriacou, Union, Mayero and Cannouan.

This is a common almost weedy herb either cultivated or persisting after cultivation and escaping into old fields. The common name for the plant is "old maids leaves" and a tea made from the plant is drunk in place of water in cases of diabetes.

NERIUM OLEANDER L. Seen on Carriacou and Cannouan.

It is often surprising to find this plant in dense thickets and woodlands on Cannouan but in all cases these healthy plants were persisting near stone walls and ruins of old houses apparently after earlier cultivation. The oleander is also under current cultivation.

PLUMERIA ALBA L. Petit St. Vincent, *Howard 10911;* Bequia, *Smiths 99;* Mustique, *Smith 163*. Also seen on Carriacou, Cannouan, Union, Mayero, the Tobago Cays, Large and White Islands.

This is a conspicuous plant of rock piles and rock outcrops throughout the Grenadines. The white flowers with yellow throats and an appealing fragrance made it one of the most attractive wild flowers of the area. The plant commonly flowers in a leafless condition although with the appearance of leaves one finds flowers and fruits in all stages of development. Specimens were seen varying from three to twelve feet in height.

RAUWOLFIA LAMARCKII A. DC. Isle of Ronde, *Howard 10748;* Carriacou, *Howard 10849, P. Beard 1201;* Petit Martinique, *Howard 10924;* Cannouan, *Howard 11095;* Bequia, *Smiths 27;* Mustique, *Smiths 141*. Also seen on Union, Mayero and the Tobago Cays.

R. Lamarckii, known locally as "milky bush," is a characteristic low shrub of dry woodlands and old fields. The plants are usually four to five feet tall although some specimens were seen which reached twelve feet in height. The leaves are variable in shape and appearance, generally appearing wrinkled. The flowers are white and the mature fruit is black although it may appear orange or red in maturing.

RHABDADENIA BIFLORA (Jacq.) Muell-Arg. Bequia, *Smiths 70, 328*.

TABERNAEMONTANA CITRIFOLIA L. Bequia, *Smiths 29*.

TABERNAEMONTANA PSYCHOTRIFOLIA H.B.K.

J. Beard lists this as a new record in the Grenadines (Carib. For. **5:** 64. 1944). I have seen no specimens referable to this South American species and do not know on what island Beard found the plant.

ASCLEPIADACEAE

ASCLEPIAS CURASSAVICA L. Mustique, *Smiths 4*. Also seen on Carriacou, Union, Mayero and Bequia.

CALOTROPIS PROCERA (Ait.) R. Br. Isle of Ronde, *Howard 10752;* Union, *Smiths 25, G. P. Cooper 201*. Also seen on Carriacou, Mayero and Cannouan.

A low herb three feet tall to a twenty foot tree with a trunk eight inches in diameter. The flowers are white with the inner surface of the petals red or purplish in color. The natives all regard this as a most handsome plant and it is frequently in cultivation near their houses.

CYNANCHUM PARVIFLORUM SW., *Metastelma parviflorum* R. Br., Bequia, *Howard 11261.*

MARSDENIA MACROPHYLLA (H.B.K.) Fourn. Large Island, *Howard 10966.* Also seen on Carriacou.

This herbaceous vine was conspicuous because of its large fruits. The species has not been reported from the Lesser Antilles before and the present determination is not positive because there are no fruiting specimens in American herbaria for comparison.

MATELEA MARITIMA (Jacq.) Woods., *Gonolobus maritima* sensu Smith. Carriacou, *Howard 10813;* Bequia, *Smiths 324, 325.* Also seen on Union, Mayero and Cannouan.

This is a very common coastal vine with semi-fleshy leaves and a conspicously warty fruit.

ROULINIA sp. Mustique, *Smiths 39.*

I have been unable to locate any specimens of this collection of the Smiths and the determination remains uncertain as published in Kew Bulletin.

SARCOSTEMMA CLAUSUM (Jacq.) R. & S. Isle of Ronde, *Howard 10763.*

This white flowered vine was abundant on the Isle of Ronde and was not seen elsewhere in the Grenadines.

CONVOLVULACEAE

CALONYCTION TUBA (Schlecht.) Colla, *Ipomoea bona-nox* sensu Smith. Prune Island, *Howard 11019;* Bequia, *Smiths 318!.*

A collector expects to find representatives of *Calonyction* along sandy and coral beaches and on coral outcrops in the Greater Antilles. The scarcity of this genus in the Lesser Antilles and especially in the Grenadines was striking. I found this plant only on one spot, a coral beach and outcrop on Prune Island. The large white flowers are particularly striking and the plant has the usual fleshy stems and leaves. The fishermen of the area are quite impressed with this plant and the single clump of these vines on Prune Island is well known and often mentioned in the southern Grenadines as an unusual but attractive flower found only on Prune.

CUSCUTA AMERICANA L. Isle of Ronde, *Howard 10780;* Carriacou, *Howard 10822.*

The dodders, *Cuscuta* and *Cassytha*, are well known as parasitic vines in the Lesser Antilles. Legislation against this plant exists in Grenada and the Grenada territory of the Grenadines. Because the plant is hunted out and destroyed its occurrence is

infrequent. Landowners must destroy plants under a legal penalty and special teams from the Department of Agriculture have permission to inspect any property for the presence of *Cuscuta*. The dodders are regarded as serious pests of coffee and cacao.

The specimens cited above were growing on *Tecoma stans* and *Pithecellobium unguis-cati*.

EVOLVULUS GLABER Spreng., *Evolvulus mucronatus* sensu Smith. Isle of Ronde, *Howard 10731;* Carriacou, *Howard 10876;* Cannouan, *Howard 11112, Smiths 30;* Mustique, *Smiths 28!*.

On the Isle of Ronde and Cannouan *Evolvulus glaber* was a characteristic component plant of the open grassy slopes on the windward coast. On Carriacou the species was found only in open shrub land of the coastal savannah areas. The plant is prostrate or with creeping stems. The flowers are a pale blue color fading to white or tan in age.

EVOLVULUS NUMMULARIUS L. Carriacou, *Howard 10951*.

A prostrate plant forming mats and growing only in the saline mangrove swamp areas. The flowers are white.

EXOGONIUM SOLANIFOLIUM (L.) Britton, *Exogonium filiforme* Choisy. Prune Island, *Howard 11021*.

This is a common, stout vine in the shrub areas. The flowers are a brilliant red color and quite conspicuous. This is another plant found on Prune Island which the fishermen consider to be unusual. It was not seen elsewhere.

IPOMOEA PES-CAPRAE (L.) Sweet, *Ipomoea biloba* sensu Smith. Bequia, *Smiths 319*. Also seen on the east coast of Cannouan and on White Island.

This species was rare in the Grenadines and elsewhere in the Lesser Antilles in contrast to the Greater Antilles where it is extremely abundant.

IPOMOEA PURPUREA (L.) Lam. Isle of Ronde, *Howard 10779*.

A rare vine on the rocks at the south end of the island.

IPOMOEA sp. Bequia, *Smiths 322, 323*.

These two collections by the Smiths were unidentified in the Kew Bulletin list and I have been unable to locate them in any American herbarium.

JACQUEMONTIA NODIFLORA (Jacq.) D. Don. Cannouan, *P. Beard 1411!*.

JACQUEMONTIA PENTANTHA (Jacq.) D. Don, *Jacquemontia violacea* sensu Smith. Union, *Howard 11018;* Cannouan, *P. Beard 1407!;* Bequia, *Smiths 4!;* Mustique, *Smiths 47*.

This blue flowered herbaceous vine is common in old fields.

MERREMIA DISSECTA (Jacq.) Hallier, *Ipomoea sinuata* sensu Smith. Carriacou, *Howard 10864;* Bequia, *Smiths 317!*.

A climbing herbaceous vine with white flowers having pink throats. The plant is known locally as "noyeau vine" and the leaves are boiled in a sugar syrup to make a cough syrup for infants.

MERREMIA UMBELLATA (L.) Hallier, *Ipomoea umbellata* sensu Smith. Bequia, *Smiths 308, 320*.

QUAMOCLIT COCCINEA (L.) Moench. Cannouan, *Howard 11117.*
A red flowered vine found occasionally in old cotton fields.

HYDROPHYLLACEAE

NAMA JAMAICENSE L. Carriacou, *Howard 10810.*
A weak prostrate herb with white flowers found in shrub thickets.

BORAGINACEAE

BOURRERIA SUCCULENTA Jacq. Isle of Ronde, *Howard 10715;* Petit St. Vincent, *Howard 10907;* Carriacou, *P. Beard 1204!;* Cannouan, *Howard 11061;* Bequia, *Smiths 141;* Mustique, *Smiths 130.* Also seen on Union and the Tobago Cays.

This is a very common plant in the Grenadines forming a major part of the shrub thickets on the windward coasts. The trees are usually less than fifteen feet tall and are contorted and partially killed by the prevailing winds and salt spray. It is known locally as "cutlass."

CORDIA ALLIODORA (R. & P.) Cham.

J. Beard (Carib. For. **5:** 64. 1944) reports a personal collection of this species from the Grenadines. The specific island is not cited and I have not seen his material.

CORDIA COLLOCOCCA L. Tobago Cays, *Howard 11029;* Mustique, *Smiths 131, 162;* Bequia, *Smiths 138.*

The specimen seen on the Tobago Cays was a fifteen foot bush with a distinctive, tan-colored bark. The plant was noticeably different from other species of *Cordia* in having extremely fragile branches.

CORDIA CURASSAVICA (Jacq.) R. & S., *Cordia cylindrostachya* sensu Smith. Isle of Ronde, *Howard 10766;* Kick 'em Jenny, *Howard 10787;* Petit St. Vincent, *Howard 10914;* Carriacou, *Howard 10837;* Cannouan, *Howard 11110;* Bequia, *Smiths 87;* Mustique, *Smiths 158.*

C. curassavica is generally a scandent bush seven to fifteen feet tall. The leaves vary considerably on one plant or different plants. The bark is extremely tough and is gathered by fishermen to be woven into cords for holding fish traps or used in making lashings for boats. The common name of this plant is "wild sage."

CORDIA GLOBOSA (Jacq.) H.B.K., *Cordia dasycephala* sensu Smith. Isle of Ronde, *Howard 10742;* Carriacou, *Howard 10893;* Petit Martinique, *Howard 10922;* Union, *Smiths 36;* Cannouan, *Smiths 18, Howard 11109.*

A five foot bush of dry shrub lands with scrambling branches. The flowers are white and the fleshy fruit bright red. The plant is known locally as "man black sage" and the leaves are used to make a tea considered good for treating colds.

CORDIA OBLIQUA Willd., *Cordia tremula* sensu Smith. Petit St. Vincent, *Howard 10913;* Union, *Howard 10980;* Cannouan, *Howard 11094;* Bequia, *Smiths 123.*

This is a common weed tree of old fields; however, it appears to grow natively in manchineel thickets along the coasts. The plants are usually about twenty feet tall. The flowers appear before the leaves at the be-

ginning of the rainy season. The sticky gelatinous fruits are inflicted on all uninitiated strangers on Union Island. Locally the plant is known as "manjack" or "sticky cherry."

CORDIA SEBESTENA L. Carriacou, *Howard 10943*.

Two handsome specimens of this species are found in the town of Hillsborough on Carriacou. The trees are twenty to thirty feet tall and were in full flower and fruit in March. The salmon-orange flowers and the large white fruits make this a distinctive ornamental tree.

CORDIA SULCATA DC.

This species, with the common name of "mandrake" were reported from Carriacou by Dr. Nichols in his diary. I did not find any material of it during my stay there in 1950.

HELIOTROPIUM ANGIOSPERMUM Murr. Carriacou, *Howard 10803*.

Only a few specimens of this widely distributed species were seen in an area heavily browsed by goats. The flowers are white.

HELIOTROPIUM CURASSAVICUM L. Isle of Ronde, *Howard 10727;* Union, *Smiths 34!;* Mustique, *Smiths 21*. Also seen on the Tobago Cays and Cannouan.

This plant on the Isle of Ronde was a low almost prostrate succulent herb with white flowers and was found in the grassy savannahs on the windward side of the island.

HELIOTROPIUM INDICUM L. Bequia, *Smiths 230, 231;* Mustique, *Smiths 19*. Also seen on Union, Mayero and Cannouan.

This is perhaps the most common species of *Heliotropium* in the Grenadines and it is a weed of old fields.

HELIOTROPIUM TERNATUM Vahl., *Heliotropium fruticosum* sensu Smith. Bequia, *Howard 11229, Smiths 186*. Also seen on Cannouan.

Plants of *H. ternatum* are scrambling low woody herbs. The leaves are scabrous and the flowers are white. The plant is most abundant in *Opuntia* thickets.

TOURNEFORTIA GNAPHALODES L. White Island, *Howard 10970;* Bequia, *Smiths 7;* Mustique, *Smiths 26!*. Also seen on Mayero, Tobago Cays, Carriacou and Cannouan.

Only occasional plants of this low shrub were seen in any one location. It is not nearly as abundant in the Grenadines as in islands of the Greater Antilles.

TOURNEFORTIA VOLUBILIS L. Isle of Ronde, *Howard 10772;* Carriacou, *Howard 10808;* Cannouan, *Howard 11059;* Bequia, *Smiths 135;* Mustique, *Smiths 38*. Also seen on Union.

A scandent woody vine climbing over the tops of other shrubs. The flowers are yellow and the fruit green. This is one of the most common woody vines in dry open woodlands.

VERBENACEAE

AEGIPHILA MARTINICENSIS Jacq.

J. Beard (Oxford For. Mem. **21**: 147. 1949) reports this species occurring

in the shrub layer on Mt. Royal on Cannouan. I have not seen specimens of this species from the Grenadines.

AVICENNIA NITIDA Jacq. Carriacou, *Howard 10955;* Bequia, *Smiths 65.* Also seen on the Isle of Ronde, Cannouan, Union and the Tobago Cays.

The oldest trees and those of the largest diameter as seen on Carriacou are members of this species. The Carriacou trees were also unusual in my experience in having extensive developments of adventitious roots in large clusters from the upper part of the trunk and the branches. The usual pneumatophores appearing from the ground around the tree were also present but the aerial development of roots was unusual. These aerial adventitious roots rarely exceeded a foot in length but many of the clusters of roots were three feet in diameter.

Several of the abandoned salt ponds on the Isle of Ronde have grown back in pure stands of *A. nitida.* These plants appear to be of a uniform age and are approximately thirty feet tall and have a trunk diameter of eight to ten inches at breast height.

CITHAREXYLUM SPINOSUM L., *Citharexylum quadrangulare* sensu Smith. Isle of Ronde, *Howard 10733;* Petit St. Vincent, *Howard 10910;* Bequia, *Smiths 43, 44;* Mustique, *Smiths 140!.* Also seen on Carriacou, Cannouan and Union.

A white flowered tree of shrub areas. The plants are usually eighteen to twenty feet tall.

CLERODENDRON ACULEATUM (L.) Schlecht. Mayero, *Howard 11051;* Bequia, *Smiths 79!;* Mustique, *Smiths 127.*

This plant was seen only on the windward coast of Mayero where it grew in profusion on the landward side of the *Coccoloba uvifera* association. It is generally a bush about six feet tall but with long arching branches extending out ten to fifteen feet from the base of the plant. The perianth of the flowers is white in contrast with the purple anthers. The plant is called "privy fence" or "privi fence" on Mayero and a tea made from the leaves is used to alleviate pain during the labor of childbirth.

CORNUTIA PYRAMIDATA L. Bequia, *Howard 11256, Smiths 63!.*

This easily recognized tree was without flowers or fruits in March. It was an occasional component of the vegetation on dry hillsides.

LANTANA CAMARA L. Union, *Howard 11120;* Bequia, *Smiths 185.*

L. camara is a very common shrub and weedy plant of the islands of the Greater Antilles. I saw only one small plant, two feet tall, in the Grenadines. Only one man on Union Island knew this plant. He was from Antigua and had seen it there but the plant was unfamiliar to the other inhabitants of Union. There are several specimens on Bequia, however, but all are

under cultivation near houses. There the plant is called "wild black grape" or "pomeroon" and the leaves are used in a sweetened tea to relieve amenorrhea and also in the treatment of morning sickness during pregnancy.

LANTANA INVOLUCRATA L. Carriacou, *Howard 10799;* White Island, *Howard 10971;* Union, *Smiths 35;* Bequia, *Smiths 3, 182!, 183, 184;* Mustique, *Smiths 87.* Also seen on Cannouan and the Tobago Cays.

This is the most common species of *Lantana* in the Grenadines. The plants are generally bushes six to eight feet tall and are usually found on dry hillsides. The flowers are lavender and the fruits rose-purple. The plant is known locally as "sweet sage" or "wild black sage" and a tea made from the leaves is considered the best treatment for colds.

LANTANA RETICULATA Pers. Petit Martinique, *Howard 10919;* Cannouan, *Howard 11083;* Bequia, *Howard 11277.*

A four foot shrub usually found on dry rocky hill crests in open woodlands. The flowers are lavender and the fruits a deep red color. The plant is called "bay balsam," "sweet sage" or "nux vomica" on various islands. A tea made from the leaves is used for treating colds.

PHYLA NODIFLORA (L.) Greene, *Lippia nodiflora* sensu Smith. White Island, *Howard 10968;* Bequia, *Smiths 187.*

The White Island specimen was growing on the open sand of the spit. The plant had prostrate branches which rooted freely at the nodes. The flowers were white.

PHYLA REPTANS H.B.K., *Lippia reptans* sensu Smith. Union, *Howard 11013;* Mustique, *Howard 11226, Smiths 13;* Bequia, *Smiths 200.*

A prostrate herb which roots freely at the nodes. It was found on open grassy areas either at the crest of the ridges or on the grassy slopes of windward coasts. The flowers are white and subtended by purple bracts.

PRIVA LAPPULACEA (L.) Pers., *Priva echinata* sensu Smith. Carriacou, *Howard 10806;* Bequia, *Smiths 216;* Union, *Smiths 31.*

This herbaceous plant was extremely abundant on an overgrazed pasture area on the Isle of Ronde. All of the animals there, sheep and calves, were heavily laden with the fruits of this plant. Its method of distribution was obvious. The plant is called "rabbit meat" and a tea made from the plant was used as a nutritional tonic for both adults and children.

STACHYTARPHETA JAMAICENSIS (L.) Vahl. Carriacou, *Howard 10842;* Large Island, *Howard 10969;* Bequia, *Smiths 224!;* Mustique, *Smiths 20.* Also seen on Union and Cannouan.

A herbaceous plant of old cultivated fields and open sandy beach areas along the coast. The branches are prostrate ascending and bear blue flowers. The common name of this plant is "vour vine" and a tea of the leaves is administered to clear up mothers milk following childbirth.

LABIATAE

COLEUS AMBOINICUS Lour. Isle of Ronde, *Howard 10755.*

This species has persisted following former cultivation. A single patch of this weak sprawling plant with trailing semi-woody stems to seven feet long was found on a dry hillside. The foliage is succulent and extremely aromatic. It was called "wild thyme" by the people on the Isle of Ronde.

HYPTIS PECTINATA Poit. Bequia, *Smiths 212.*

LEONURUS SIBIRICUS L. Bequia, *Smiths 219.*

LEONOTIS NEPETAEFOLIA (L.) R. Br. Bequia, *Smiths 225.* Also seen on Carriacou, Union, Mayero and Cannouan.

The common name for this species is "bald head," "bald bush" or "ball head." The leaves are used in a tea for stomach pains and a poultice of the leaves is used in treatment of eczema.

LEUCAS MARTINICENSIS (Jacq.) R. Br. Isle of Ronde, *Howard 10744;* Union, *Smiths 19;* Bequia, *Smiths 243.*

A common white flowered weed of formerly cultivated fields.

OCIMUM MICRANTHEMUM Willd. Carriacou, *Howard 10825;* Bequia, *Smiths 213;* Mustique, *Smiths 88.* Also seen on Union Island.

An aromatic herb growing in profusion in formerly cultivated fields. The white flowers are streaked with lavender. The plant is known locally as "basil" and "desmodium." A tea of leaves is used for treating colds in infants and for dysmenorrhea in women.

OCIMUM BASILICUM L.

A few plants of this were grown in pots on Bequia. The plant is known as "sweet balsam" and a tea of the leaves is used to treat coughs and colds in adults.

SALVIA COCCINEA B. Juss. ex Murr. Bequia, *Smiths 222.*

SALVIA OCCIDENTALIS Sw. Bequia, *Smiths 217.*

SOLANACEAE

CAPSICUM BACCATUM L., *Solanum retrofractum* sensu Smith. Isle of Ronde, *Howard 10739;* Carriacou, *Howard 10828;* Bequia, *Smiths 180;* Mustique, *Smiths 77.*

A weak herbaceous plant climbing to eight feet in height when supported by other plants.

DATURA FASTUOSA L. Bequia, *Smiths 236.*

DATURA METELOIDES DC. Cannouan, *Howard 11119.* Also seen on Carriacou and Mayero.

A low woody herb to two feet tall found only in waste and dump.

LYCIUM TWEEDIANUM Griseb. var. CHRYSOCARPUM (Urb. & Ekm.) Hitchc. Prune Island, *Howard 11020.*

An extensive development of this shrub is found on the leeward side of the northeast corner of Prune Island. It is another one of the unusual plants of the Greater Antilles found on Prune and not elsewhere in the Grenadines. The plants were mostly leafless with only a few red fruits present. Previous reports of this plant are from the Greater Antilles only.

PHYSALIS PUBESCENS L., *Physalis minima* sensu Smith. Bequia, *Smiths 238.*

PHYSALIS TURBINATA Medik., *Physalis angulata* sensu Smith. Bequia, *Smiths 239.*

SOLANUM IGNEUM L. Carriacou, *Howard 10814;* Bequia, *Smiths 232, Eggers 7065;* Mustique, *Smiths 78, 79!.* Also seen on Cannouan.

A four foot shrub with bluish-white flowers. Usually found on dry open hillsides. Schulz (Urb. Symbol. Ant. **6:** 225. 1909) considers *S. igneum* to be a variety of *S. racemosum.* Judging from the aspects of the plants in the field there are substantial differences that merit considering *S. igneum* a distinct species.

This plant has the common name of "conca berry." The leaves are used to make a tea given in treatment of sore throat, quinsy, and tonsilitis.

SOLANUM LANCIFOLIUM Jacq. *Solanum bahamense* sensu Smith. Isle of Ronde, *Howard 10747;* Carriacou, *P. Beard 1205;* Petit Martinique, *Howard 10930;* Bequia, *Smith 234;* Mustique, *Smiths 76.*

A spiny scandent shrub with white flowers and orange fruits.

SOLANUM MAMMOSUM L. Union, *Smiths 26!.*

SOLANUM NODIFLORUM Jacq., *Solanum nigrum* sensu Smith. Bequia, *Smiths 237!.*

SOLANUM RACEMOSUM Jacq. Kick 'em Jenny, *Howard 10783.*

A five foot plant, slightly woody at the base, growing along the seacoast. The leaves are succulent. Schulz (Symbol. Ant. **6:** 225. 1909) cites a collection by the Smiths, numbered 698, as collected on Bequia. I cannot locate this in the Kew Bulletin list of the Smiths' collections and have not seen material of this species from Bequia.

SOLANUM TORVUM SW. Bequia, *Smiths 235!.*

SCROPHULARIACEAE

CAPRARIA BIFLORA L. Union, *Smiths 21;* Bequia, *Smiths 209, 210, 211;* Mustique, *Smiths 7.* Also seen on Carriacou, Mayero and Cannouan.

SCOPARIA DULCIS L. Carriacou, *Howard 10952;* Bequia, *Smiths 208.*

An herbaceous plant with white flowers found locally at the inland margins of mangrove swamps.

BIGNONIACEAE

CRESCENTIA CUJETE L.

Several specimens of the "calabash" were seen in the northwest corner of Cannouan and in old cultivated fields which have now grown up into dense shrub lands. They are apparently residual from former cultivation.

DOXANTHA UNGUIS-CATI (L.) Rehd., *Bignonia unguis* sensu Smith. Bequia, *Smiths 321;* Mustique, *Smiths 40.* Also seen on Carriacou, Mayero and Union.

This woody vine was seen on several islands but was nowhere abundant. Only old fruits were present in March.

MACROCATALPA LONGISSIMA (Jacq.) Britton.

Stehlé (Carib. For. **8:** 107. 1947) reports this species as occurring in the Grenadines. He does not cite a specific locality and I have seen no specimens from the area.

TABEBUIA PALLIDA Miers, Isle of Ronde, *Howard 10768;* Mayero, *Howard 11046;* Union, *G. P. Cooper 200!.* Also seen on all other islands visited.

This is one of the most abundant trees in the Grenadines and one of the most highly valued. It was seen as an element of the windswept eastern coastal shrub thickets. The trees are eight to fifteen feet in height and three to eight inches in diameter at breast height. The leaves are variable having one to five leaflets on the same tree. The flowers are large and pink and quite attractive.

"White cedar," or "cedar," as the plant is called in the Grenadines, supplies one of the principal woods used in making boat stays. The contorted trunks, due to the effects of the prevailing winds, are carefully selected for the proper curve and carefully worked for a stay. According to Dr. Nichols' diary this tree was very abundant in 1891 and the wood was exported as well as used locally in the extensive boat building industry that then flourished. At the present time the trees are all small and are cut as soon as they reach a usable size.

TABEBUIA sp. Bequia, *Smiths 69;* Mustique, *Smiths 134.*

No specimens of these collections are available for study in the American herbaria.

TECOMA STANS (L.) H.B.K. Mayero, *Howard 11052;* Bequia, *Smiths 59;* Mustique, *Smiths 133.* Also seen on the Isle of Ronde, Carriacou, Union, Tobago Cays, and Cannouan.

This is one of the most attractive shrubs of the Grenadines. The plants are three to six feet tall and flower very heavily during the dry season.

ACANTHACEAE

ANDROGRAPHIS PANICULATA Nees. Bequia, *Smiths 2.*

ANTHACANTHUS ACICULARIS Nees. Petit St. Vincent, *Howard 10916;* Petit Martinique, *Howard 10933.*

This species was found only at the summit of Petit Martinique growing on the exposed pile of rocks and in a similar habitat at the east end of Petit St. Vincent. The plants were about five feet tall with long arching spreading branches. The small foliage, gray branches and spines contrasted sharply with the vivid blue flowers to make this an attractive shrub.

BARLERIA LUPULINA Lindl. Carriacou, *Howard 10942.*

An attractive shrub, usually less than two feet in height. The plant is generally cultivated throughout the Lesser Antilles but existed as a residual or escaped plant on Carriacou. It was very abundant in restricted locations. The flowers are salmon-orange.

BLECHUM BROWNEI Juss. Carriacou, *Howard 10831;* Bequia, *Smiths 215, Eggers 7080!.*

A common white flowered weed of gardens and formerly cultivated fields.

JUSTICIA PERIPLOCIFOLIA Nees. Isle of Ronde, *Howard 10721;* Carriacou, *Howard 10874;* Petit Martinique, *Howard 10932;* Mayero, *Howard 11040.* Also seen on Cannouan.

A crawling or semi-scandent coarse herb with red flowers. The plant was only found in thickets of *Opuntia Dillenii.*

JUSTICIA SESSILIS Jacq. Carriacou, *Howard 10875;* Union, *Howard 10992.*

This low spreading herb had very fragile stems and an exceedingly tough tap root system. It was found at the edge of a mangrove swamp. The flowers were lavender.

JUSTICIA SPHAEROSPERMA Vahl., *Beloperone sphaerosperma* sensu Smith. Bequia, *Smith 223, Eggers 7052!.*

ODONTONEMA NITIDUM (Jacq.) Ktze., *Thyrsacanthus nitidus* sensu Smith. Bequia, *Smiths 46, 47.* Also reported from Cannouan.

RUELLIA TUBEROSA L. Carriacou, *Howard 10885;* Union, *Smiths 24;* Tobago Cays, *Howard 11032;* Cannouan, *Smiths 17;* Mustique, *Smiths 18;* Bequia, *Smiths 1.*

The local name for this common purple flowered weed is "mini root" or "minnue root." The roots are pounded then soaked in water. This liquid is drunk to cure burning after urination, nephritis or severe stomach pains.

RUELLIA sp. Bequia, *Smiths 204.*

This collection was not available in the American herbaria I have studied.

THUNBERGIA FRAGRANS Roxb. Bequia, *Eggers 7064.*

RUBIACEAE

BORRERIA LAEVIS Griseb. Bequia, *Smiths 9!, 190!* in part; Mustique, *Smiths 15!.*

The Smiths' collection numbered 190 is a mixture. One portion is *Spermacoce tenuior.*

CHIOCOCCA ALBA (L.) Hitchc.

Stehlé lists this species from the Grenadines without mentioning a specific island (Carib. For. **8:** 107. 1947). I have not seen any material which could be referred here.

CHIOCOCCA PARVIFLORA Wullschl. Bequia, *Smiths 48.* Also seen on Cannouan.

This is a relatively common woody vine on the leeward side of Cannouan. The flowers are yellow or white in color and the fruit is white.

CHOMELIA FASCICULATA Sw. Bequia, *Smiths 78.*

This species is also reported from Carriacou by Beard (Oxford For. Mem. **21:** 147. 1949).

ERITHALLIS FRUTICOSA L. Carriacou, *Howard 10956;* Union, *Howqrd 10998, 11000;* Bequia, *Smiths 41, 42;* Mustique, *Smiths 161.* Also seen on Cannouan.

A shrub four feet tall to small trees reaching twelve feet in height occurring on coral sand in association with *Coccoloba uvifera* or *Hippomane Manchinella* or on rocky outcrops along the ridges in mixed dry woodlands. The flowers are white and the fruit blue-black on maturity. As in the Greater Antilles this species varies considerably in the shape, thickness, glossiness and color of the leaves.

EXOSTEMA CARIBAEUM (Jacq.) R. & S. Carriacou, *Howard 10888;* Petit St. Vincent, *Howard 10902;* Bequia, *Howard 11247, Smiths 111;* Mustique, *Smiths 147.* Also seen on Union, the Tobago Cays, Mayero and Cannouan.

An eighteen to twenty foot tree occurring only on the rocky outcrops at higher elevations. The foliage is characteristically dark green or almost purple. The flowers are white and the mature fruit is black.

GENIPA AMERICANA L. Isle of Ronde, *Howard 10754;* Carriacou, *P. Beard 1212!;* Cannouan, *Howard 11102;* Bequia, *Smiths 115;* Mustique, *Smiths 154!.* Also seen on Union, Tobago Cays and Mayero.

A twenty to twenty-five foot tree found only on the leeward sides of the islands. The mature fruit is yellowish or brown in color.

GONZALAGUNIA SPICATA (Lam.) G. Maza, *Gonzalea spicata* sensu Smith. Bequia, *Smiths 113.*

GUETTARDA PARVIFLORA Vahl., *Guettarda odorata* sensu Smith. Union, *Howard 10991;* Cannouan, *Howard 11056, 11068;* Bequia, *Smiths 75, 76;* Mustique, *Smiths 150!.* Also seen on Carriacou.

A twelve to fifteen foot bush with the short branches spine-like. The plant is invading old cultivated fields at the lower elevations and forms a part of the mixed thorn shrub at the ridge elevations. The branches are characteristically flat and spreading.

GUETTARDA SCABRA (L.) Lam. Union, *Howard 11009;* Cannouan, *Howard 11078;* Bequia, *Howard 11245, Smiths 60, 61;* Mustique, *Smiths 144.*

A very common plant in the dry woodland or in shrub thickets. On formerly cultivated lands this plant is a low shrub with numerous adventitious branches developed. These shoots are commonly cut for use as poles in house construction. In the older shrub thickets and the woodland areas this species becomes a tree reaching twenty-five feet in height. The diameter at breast height may be six to ten inches. The bark is characteristically light gray in color and gouged in appearance. The leaves are scabrous above. The flowers are white and the mature fruit is greenish-brown.

PSYCHOTRIA BERTERIANA P. DC., *Psychotria pyramidalis* and *P. platyphylla* sensu Smith. Bequia, *Smiths 117, 118.*

PSYCHOTRIA MICRODON (DC) Urb., *Psychotria horizontalis* sensu Smith. Isle of Ronde, *Howard 10750;* Carriacou, *Howard 10866;* Cannouan, *Howard 11108;* Bequia, *Smiths 110.*

A shrub of roadsides and formerly cultivated fields. The plants are four to six feet tall with arching or scrambling branches often ten feet long. The mature fruit is red-orange in color.

PSYCHOTRIA NERVOSA DC., *Psychotria undata* Jacq. Bequia, *Smiths 26, 28.*

This plant is known locally as "St. John's Bush." A tea made from the leaves is considered excellent for building blood and cleansing the blood and is used in the treatment of anemia.

RANDIA ACULEATA L. *Randia mitis* sensu Smith. Isle of Ronde, *Howard 10737;* Carriacou, *Howard 10887;* Petit St. Vincent, *Howard 10905;* Cannouan, *Smiths 5;* Bequia, *Smiths 86;* Mustique, *Smiths 149.* Also seen on Union, Mayero, the Tobago Cays and Balliceaux.

One of the most common shrubs of the windswept windward coasts. The plants are generally drastically contorted by the wind often growing in a prostrate fashion away from the prevailing winds (plate 17). In protected places the plants may reach a height of twelve feet with a candelabra branching habit. The flowers are white and the mature fruit creamish-white.

SPERMACOCE TENUIOR Lam. Union, *Smiths 20;* Bequia, *Smiths 10, 189, 190!* in part.

CUCURBITACEAE

CERATOSANTHES PALMATA (L.) Urb. *Ceratosanthes corniculata* (Lam.) Cogn., *Ceratosanthes tuberosa* sensu Smith. Isle of Ronde, *Howard 10764;* Cannouan, *Howard 11073;* Bequia, *Howard 11282, Smiths 314;* Mustique, *Smiths 36, 43.*

This unusual vine was very abundant in a few places in the Grenadines. The white flowers appear on the leafless green stems. The fruits were green at maturity.

CITRULLUS VULGARIS Schrad. Bequia, *Smiths 326.*

CORALLOCARPUS EMETOCATHARTICUS (Gros.) Cogn. Isle of Ronde, *Howard 10714;* Cannouan, *Howard 11106;* Mustique, *Howard 11228.*

This was a conspicuous and very unusual vine, growing in the tops of the shrub thickets. The stems appear jointed with each joint swollen and the effect was that of a string of sausages. The tan-yellow flowers appeared in sub-sessile clusters before the leaves. The few leaves present on the plant were scabrous. The fruit, about the size of *Chrysophyllum oliviforme,* was green.

CUCUMIS ANGURIA L. Union, *Howard 11012.* Also seen on Carriacou, Mayero and Cannouan.

A very abundant vine on Union Island usually found in grassy areas, pastures. The flowers are yellow and the fruit yellow or orange at maturity. The local name for this plant is "warty cucumber."

MORMORDICA CHARANTIA L.

Specimens of this plant were seen on Carriacou, Union, Cannouan and Bequia. It has the appropriate common name of "maiden's blush" sometimes changed to "maiden's bush" or "maiden's brush." The plant is used throughout the islands for its known property of inducing an

abortion. The men, however, find the plant useful for increasing the appetite and curing indigestion.

COMPOSITAE

BIDENS CYNAPIIFOLIA H.B.K. Isle of Ronde, *Howard 10724;* Carriacou, *Howard 10962.* Also seen on Union, Mayero and Bequia.

Occurs either as a roadside weed near old cultivated fields or more commonly as an abundant weedy plant of the *Opuntia* or shrub zones on the windswept eastern coasts.

CHAPTALIA NUTANS (L.) Polak. Bequia, *Smiths 290.*

ECLIPTA ALBA (L.) Hassk., *Eclipta erecta* sensu Smith. Mayero, *Howard 11036;* Bequia, *Smiths 304!.*

EGLETES PROSTRATA (Sw.) Ktze. Bequia, *Howard 11257.*

This species was growing on the sandy beach in the center of Port Elizabeth at the high tide mark. The prostrate plant formed a mat fully five feet in diameter.

ELEUTHERANTHERA RUDERALIS (Sw.) Schultz-Bip., *Eleutheranthera ovata* sensu Smith. Bequia, *Smiths 205.*

EMILIA SAGITTATA (Vahl.) DC. Carriacou, *Howard 10847.*

A red flowered weedy herb of cotton fields.

EMILIA SONCHIFOLIA P. DC. Bequia, *Smiths 291;* Mustique, *Smiths 82.*

ERIGERON BONARIENSIS L. Bequia, *Smiths 206, 329.*

EUPATORIUM ODORATUM L. Carriacou, *Howard 10824;* Cannouan, *Howard 11104;* Mustique, *Smiths 83.*

A lavender flowered bush, usually five to six feet tall, found on dry open hillsides. The branches of this plant are weak, resting on or climbing through adjacent shrubs. The plant is known locally as "christmas bush." The leaves are used to make a tea for the treatment of coughs and colds and is given in milk to children for the croup or bronchitis.

LAGASCEA MOLLIS Cav. Carriacou, *Howard 10830.*

A weed of cotton fields. The pubescence gives the foliage of this plant a grayish-white appearance. The bracts of the inflorescence turn a vivid red-orange color after the achenes have been shed.

MELANTHERA NIVEA (L.) Small, *Melanthera deltoides* sensu Smith. Union, *Smiths 37;* Bequia, *Smiths 203.*

PARTHENIUM HYSTEROPHORUS L. Carriacou, *Howard 10797;* Bequia, *Smiths 299;* Mustique, *Smiths 80.* Also seen on Union, the Tobago Cays, Mayero and Cannouan.

This plant is an abundant weed especially on Carriacou where old garden areas appear white with flowering specimens.

PECTIS HUMIFUSA Sw. Isle of Ronde, *Howard 10729;* Carriacou, *Howard 10875;* Mustique, *Smiths 24.* Also seen on the Tobago Cays and Cannouan.

Pectis humifusa is a mat-forming plant of coastal coral rock outcrops. It is also the dominant plant on many of the savannah areas on the windward slopes of the Grenadine Islands. Such areas often appear dotted with gold when this plant is in full bloom.

PECTIS LINIFOLIA L., *Pectis punctata* sensu Smith. Carriacou, *Howard 10959;* Union, *Howard 11005, Smiths 23, 24;* Bequia, *Smiths 300.* Also seen on Cannouan.

This erect species of *Pectis* is found in open dry woodlands, usually on rocky slopes. The flowers are pale yellow and surrounded by deep orange bracts.

POROPHYLLUM ELLIPTICUM Cass., *Porophyllum ruderale* sensu Smith. Bequia, *Smiths 292!.* Also seen on Cannouan.

PSEUDELEPHANTOPUS SPICATUS (Juss.) Rohr., *Elephantopus spicatus* sensu Smith. Carriacou, *Howard 10833;* Bequia, *Smiths 287.*

SONCHUS OLERACEUS L. Mustique, *Smiths 81.* Also seen on Carriacou.

SYNEDRELLA NODIFLORA (L.) Gaertn. Carriacou, *Howard 10963.*

A yellow flowered semi-prostrate roadside weed. Not abundant.

TRIDAX PROCUMBENS L. Carriacou, *Howard 10844, P. Beard 1203!.* Also seen on Union, Mayero and Cannouan.

An abundant plant forming colonies. The stems or branches are prostrate with the peduncles erect. The ray flowers are white.

TRIXIS RADIALIS (L.) Ktze. Isle of Ronde, *Howard 10734;* Petit Martinique, *Howard 10926.*

A weak, sprawling or scrambling arching plant to four feet tall with branches often seven to ten feet long. The flowers are yellow. Locally abundant on exposed rock piles.

VERNONIA CINEREA (L.) Loess. Carriacou, *Howard 10960.*

VERNONIA ARBORESCENS (L.) Sw. Bequia, *Smiths 297.*

VERNONIA GRACILIS H.B.K. subsp. TOMENTOSA Ekm., *Vernonia tricholepis* sensu Smith. Bequia, *Smiths 288.*

This collection with the Smiths' number was collected by Joseph Dalton. Ekman cites this specimen in his monograph of the West Indian *Vernoniae* (Arkiv För Botanik 13, **15:** 25. 1914). *Vernonia tricholepis* DC. is referred to the synonymy of *V. tricephala* Gardn. The occurrence of the present species in Bequia is unusual since the species is native to Colombia.

WEDELIA FRUTICOSA Jacq.

Stehlé cites this species as occurring in the Grenadines (Carib. For. **8:** 110. 1947) but without specific location. I have not seen material from the Grenadines which could be referred here.

WEDELIA JACQUINI L. C. Rich. var. INVOLUCRATA O. E. Schulz., *Wedelia buphthalmoides* sensu Smith. Isle of Ronde, *Howard 10767;* Petit Martinique, *Howard 10925;* Carriacou, *Howard 10798;* Union, *Howard 11008;* Cannouan, *Howard 11079;* Bequia, *Howard 11278, Smiths 294, 295, Eggers 7047;* Mustique, *Smiths 84.*

This is an abundant and extremely variable plant in the field. Commonly the species will dominate areas of dry shrub land occurring most frequently on rock outcrops. The plants are generally three to five feet tall in exposed areas and reach seven to eight feet in height in protected locations. The flowers are yellow and the plant is attractive.

WEDELIA CALYCINA L. C. Rich.

Stehlé cites this species but without reference to a specific island in the Grenadines (Carib. For. **8:** 110. 1947). Schulz (Symbolae Antillanae **7:**

102. 1911) refers this species to varietal status under *W. Jacquini*. I have seen no material referable to this taxon from the Grenadines.

ZINNIA ELEGANS Jacq.

While this species is widely cultivated in the Grenadines the plant has escaped on Carriacou and is found as a roadside weed or occurring in abundance in cotton fields or formerly cultivated areas.

ORIGINS AND RELATIONSHIPS OF THE GRENADINE FLORA

A map survey of the Grenadines would lead one to predict a diversified and interesting vegetation on the basis of the location and the relief of the islands. A visit to the area produced the preceding list of species present in the Grenadines, a list which shows that the vegetation of the Grenadines is today entirely a secondary vegetation of the dry woodland type. The demands of the past and present large population on the land for agriculture and on the forests for fuel have decimated the vegetation on all of the islands. The vegetation that exists in the Grenadines today is largely of pan-tropical species with a very low percentage of endemic species.

Beard (1944c) personally collected, or found reports in the literature, only 86 species of trees or woody shrubs in the Grenadines. Of these, 55 species (65%) were of wide or "universal" range, 11 species (12%) were also found in the Greater Antilles, while 10 species (11%) were of continental South American distribution prolonged into the Lesser Antilles and another 10 species (11%) were considered as endemic to the Lesser Antilles.

The Stehlés (1947) had records or personal collections of 17 additional species bringing the total tree and shrub flora of the Grenadines to 103 species with negligible alteration of the percentage composition. The Stehlés list for the large neighboring islands of St. Vincent and Grenada, 320 and 229 species of woody plants respectively indicating the paucity of the Grenadine flora.

The two lists given by Beard and the Stehlés are based to a large extent on distribution records given in the floras published between 1859 and 1945. A herbarium study of more recent collections of these so-called endemic species, or those with Continental or Greater Antillean affinities, indicates a still wider range for many of the species with a resulting decrease in the percentages given above for the Grenadine flora.

The list of species reported for the Grenadines, forming a portion of this paper, is based primarily on my own collections and the report of the collections of H. H. and G. W. Smith. It is far from complete in that my collections represent the flora during a

six weeks period of February and March. While I collected everything that could possibly be identified in fertile or sterile condition, some ephemeral species of herbs are to be expected. The list is also deceptive in that I have repeated many of the Smiths' collections of obviously cultivated plants existing in 1891, yet I made no attempt to collect the currently cultivated species and the list could be increased by at least thirty entities if the cultivated crops, and more recent ornamental introductions were included. Nevertheless, the present listing includes 483 species and varieties in the Grenadine flora. This is in contrast with the report of the collections of H. H. and G. W. Smith (Anon. 1893) listing 375 species from Bequia, 160 species from Mustique, 49 species from Union and 30 species from Cannouan. The present listing not only increases the number of species reported from the Grenadines but also shows better the diversity of the vegetation and gives a truer picture of the composition of the Grenadine flora.

Using the Stehlés' criteria for distinguishing elements within the flora, 378 species would be considered as universal in distribution and included in this category are the many cultivated plants, or those residual from former cultivation. 61 species of the native vegetation of the Grenadines have a distribution into the Greater Antilles but are not found in South America. 22 species are found in continental South America but are not found in the Greater Antilles and another 22 species could be considered endemic to the Lesser Antilles. No species were found to be endemic to the Grenadines alone.

Of the total Grenadine flora, as represented in the present list, 78.4% are of universal distribution, 12.3% have Greater Antillean affinity, 4.6% have extensions of range into South America and 4.6% are endemic to the Lesser Antilles. It is interesting to note that considering only the trees and shrubs as Beard and the Stehlés have done, or considering the entire flora as I have done, the relationship of the number of species of continental South American affinity and those considered to be endemic to the Lesser Antilles remains the same.

As might be expected from their geographical location the vegetation of Bequia is the richest in species and shows a relationship with the flora of St. Vincent, and the southernmost island, Carriacou, has a highly disturbed vegetation but with similarities to that of Grenada. The few undisturbed portions of the vegetation of Union and Cannouan, central islands of the Grenadine chain of islands, can be considered to be most typical of the dry deciduous woodland forests of the Grenadines.

Thus the Grenadines represent an isolated group of small islands of interesting location. While they were previously relatively unknown botanically, their present flora is secondary and of little value in a study of distributions and origin of Antillean vegetation. Since these islands show little hope for profitable agriculture and the inadequate water supply limits the population that can be supported, it is probable that the current vegetation will remain relatively undisturbed in the next few decades. From the information obtained from the collection records of the Smiths and Dr. Nichols' diary one can find, in comparison with the current flora, certain patterns already established in the development of the deciduous woodland type of vegetation. The Grenadines will remain an area worth watching to observe the changes that may occur in the dry woodland vegetation in succeeding years.

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EXPLANATION OF PLATES

Plate 6. The rugged profile of Union Island as seen from the northeast. The Pinnacle is the peak at the left.

Plate 7. Kick 'em Jenny from the northeast corner of the Isle of Ronde. Half Moon Bay is in the foreground. A fringe of coconut palms surrounds an old salt flat now grown up with *Avicennia nitida.*

Plate 8. A coral sand beach on the north side of Prune Island with Union Island on the horizon. *Thalassia testudinum* is visible in the shallow water.

Plate 9. A black volcanic sand beach on the south coast of Carriacou near Dumfries. The drift vegetation is Sargassum.

Plate 10. The northern grassy slopes of Petit Martinique looking towards Petit St. Vincent.

Plate 11. Looking east from the summit of the high western hill of Petit St. Vincent. Note the exposed boulders in the foreground.

Plate 12. Park-like aspect of the *Hippomane* formation on Petit St. Vincent.

Plate 13. Open park-like deciduous woodland at the summit of the western hill on Petit St. Vincent. Principal trees here are *Jacquinia, Coccoloba caribaea, Randia, Capparis coccolobifolia, Capparis indica, Forestiera, Maytenus* and *Eugenia ligustrina.* Notice the lack of soil.

Plate 14. A thicket of *Cnidoscolus urens* occupying a formerly cultivated field on Large Island south of Carriacou.

Plate 15. Abandoned agricultural land in the Chattam Bay area of Union Island. The principal trees are *Bourreria succulenta, Pisonia fragrans,* and *Acacia nilotica.* Shrub growth consists of *Melochia tomentosa* and *Croton flavens.*

Plate 16. Low shrub growth on abandoned cultivated lands on the west slopes of Balliceaux. Low flat branching specimens of *Randia aculeata* dominate the shrub with *Croton flavens* second in abundance.

Plate 17. Wind rows of *Randia aculeata* near the crest of the windward side of Balliceaux. Single rooted clumps have prostrate branches developing to the leeward side with the prevailing winds.

Plate 18. The town of Ashton on Union Island in a fertile valley beneath a 900 foot mountain. A rock paved catchment area and reservoir of recent construction can be seen at the left.

Plate 19. The windward savannah on the Isle of Ronde. *Pectis humifusa, Evolvulus glaber* and *Alternanthera polygonoides* dominate the savannah. The semi-deciduous dry woodland shows the effects of the prevailing wind and the salt spray.

Plate 20. Mt. Royal on Cannouan as seen from the south. Variation in vegetation at the lower levels indicate the different types of vegetation following abandonment of formerly cultivated fields. The upper slopes of Mt. Royal have a deciduous or semi-deciduous dry woodland vegetation type.

Plate 21. West, South and East Islands of the Tobago Cays as seen from the south shore of North Island. The shallow waters abound in spiny lobsters.

Plate 22. The rock pile at the south end of White Island, south of Carriacou as seen from the sand bar. Foreground plants are *Conocarpus erectus* and *Coccoloba uvifera. Ficus laevigata* dominates the lower portions of the hill. *Plumeria alba* is the most common plant on the rocks.

Plate 23. The sand bar of White Island as seen from the summit of the rock pile. Carriacou is on the horizon. The fringe vegetation of the sand bar comprises *Coccoloba uvifera, Suriana maritima* and *Conocarpus erectus.*

Plate 24. The stone base of an old windmill near Harvey Vale on Carriacou. Power from the windmills was used to grind cane and gin cotton. *Ficus laevigata* grows on the windmill base. *Croton flavens* dominates the shrub growth in the foreground.

Plate 25. The windward slopes of Isle of Ronde showing plants of *Cactus Broadwayi* among the tuff boulders in the foreground. *Croton flavens* forms the shrub zone before the cloud shrouded, wind contorted, semi-deciduous dry woodland.

Plate 26. New salt flats are under construction in an old mangrove swamp on Prune Island. Picture looks east from the summit of the western hill.

Plate 27. Deciduous dry woodland on Mustique. *Acacia nilotica, Coccoloba caribaea,* and *Pisonia fragrans* dominate this woodland.

Plate 28. Harvesting the crop of sea island cotton on Mayero. The preponderance of weeds indicates the poor agricultural practices of much of the Grenadines.

Plate 29. The boat building industry of the Grenadines has depended on the now nearly exhausted supply of *Tabebuia pallida* for the stays. In the background is the north slope of High North on Carriacou, once cultivated land now abandoned to pasture.

Plate 3. Carriacou and adjacent islands.

CANNOUAN

TOBAGO CAYS

UNION

One Mile

Plate 4. The southern islands of the St. Vincent Grenadines.

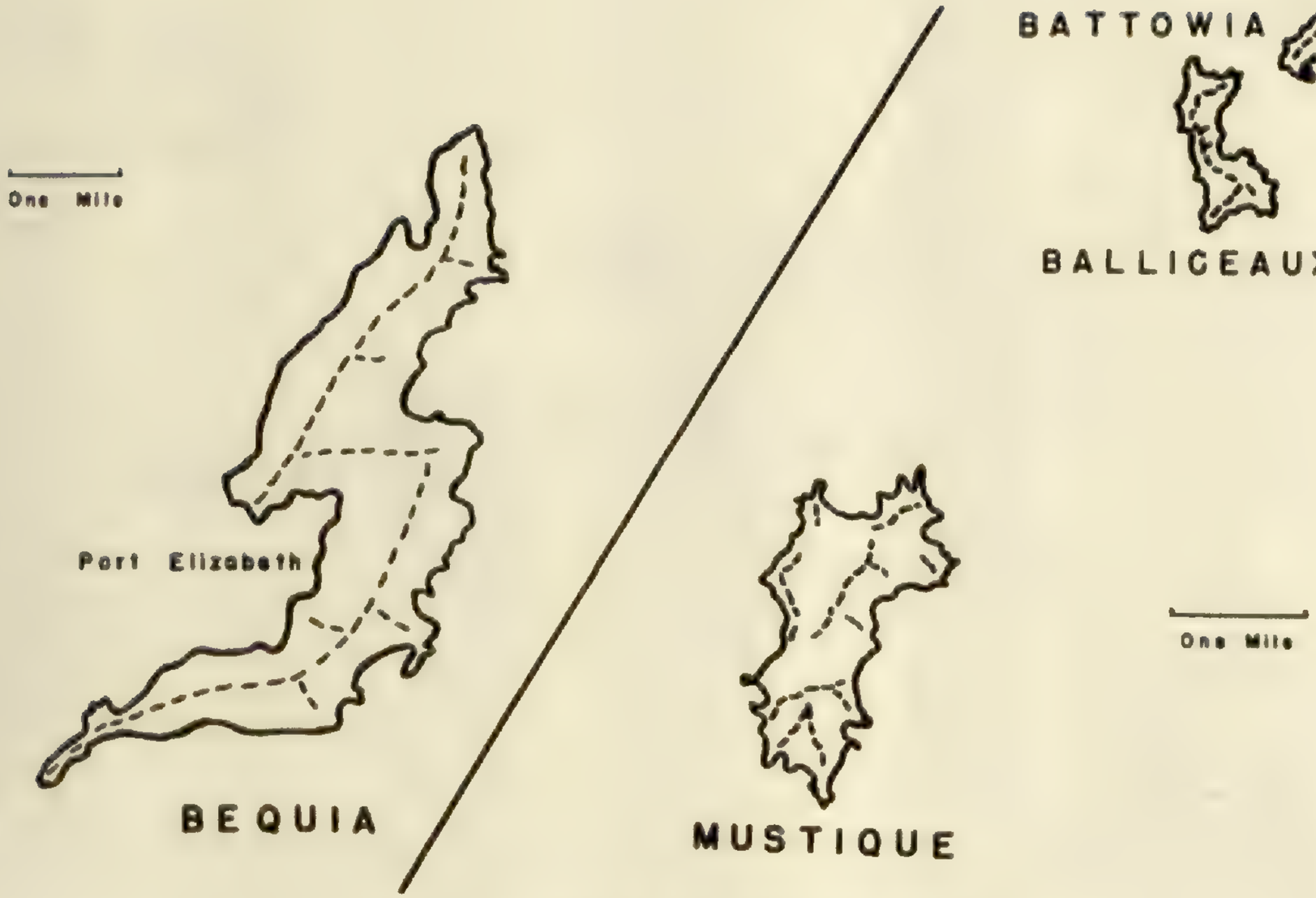

Plate 5. Bequia and adjacent islands.

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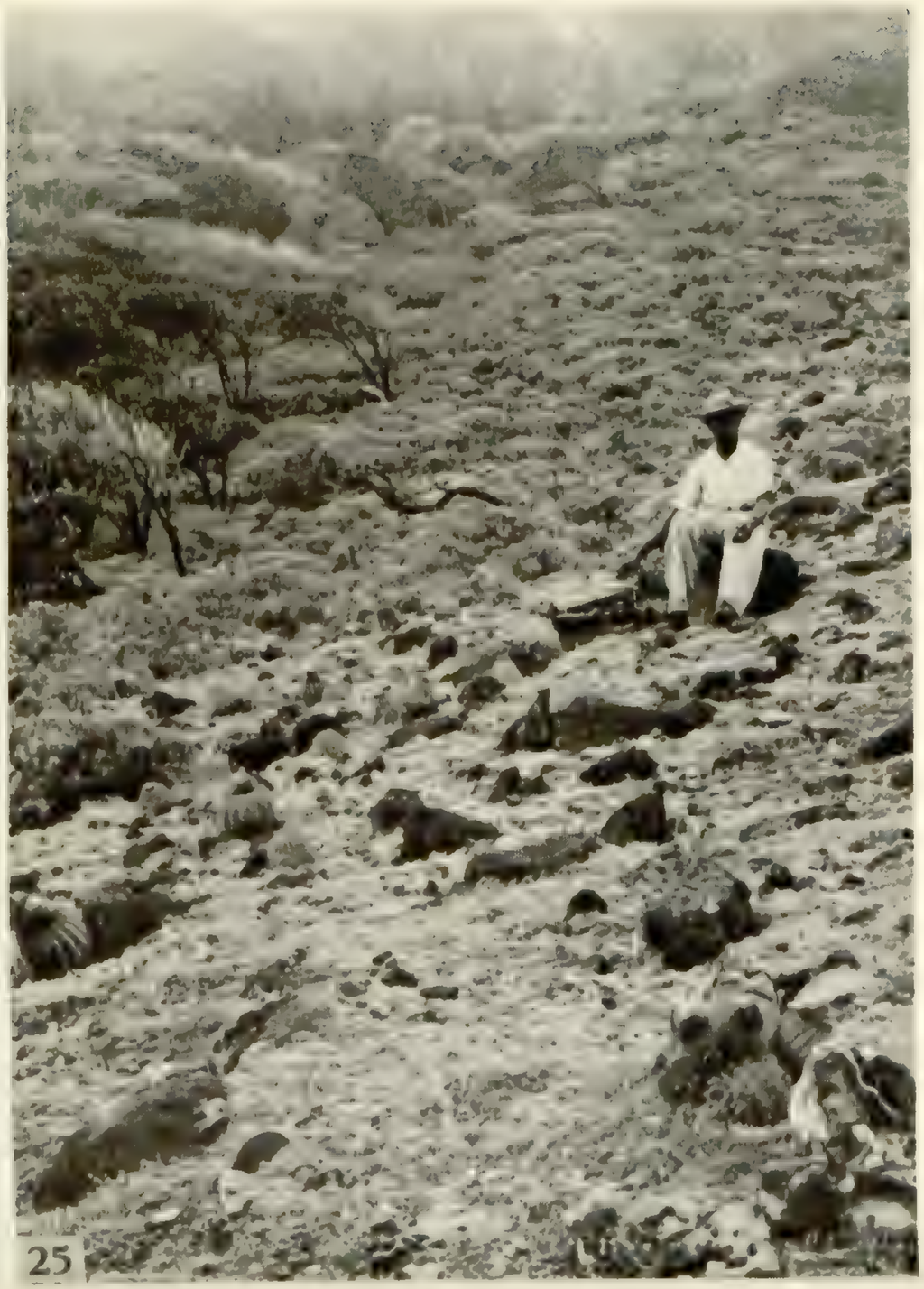

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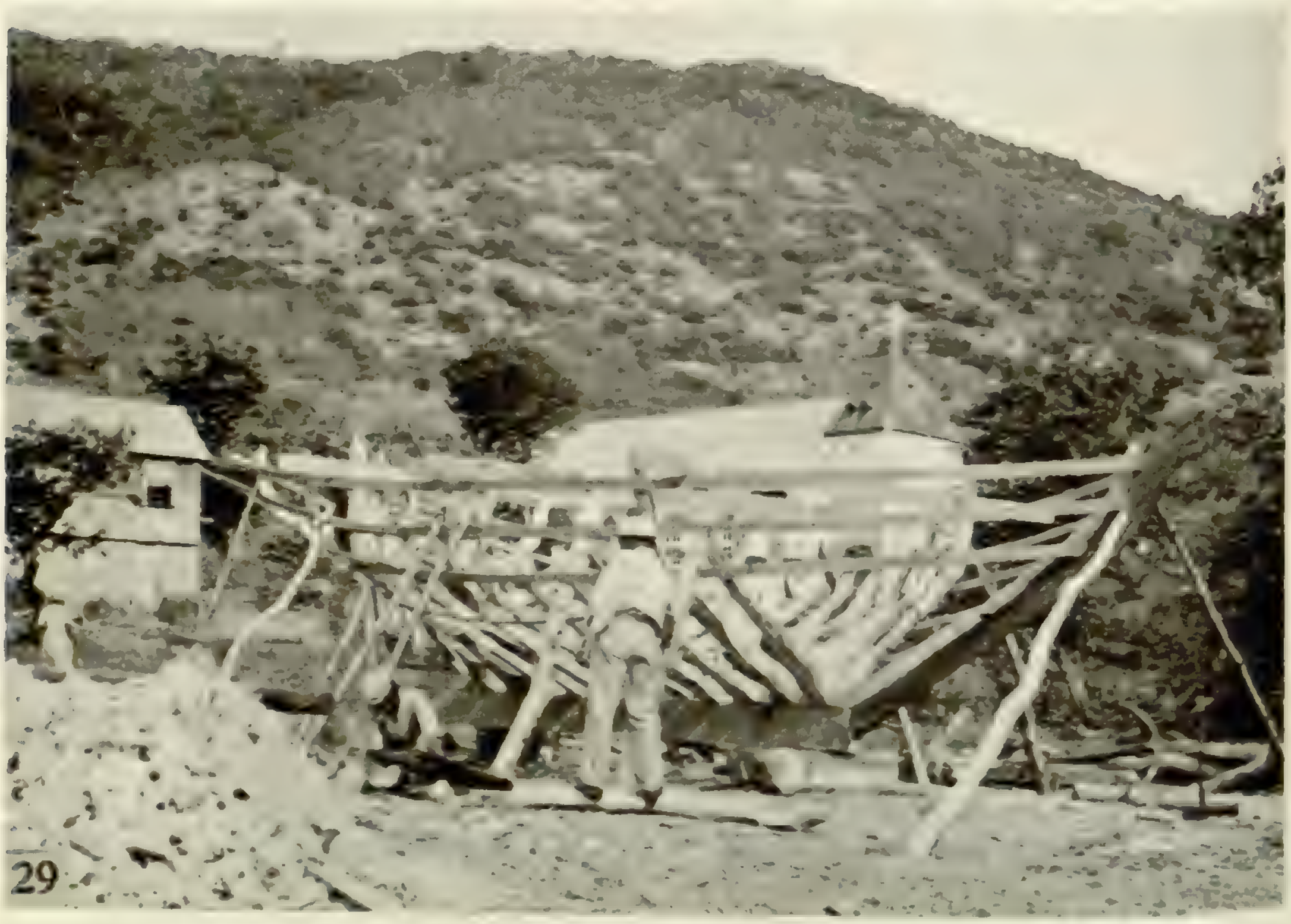

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NO. CLXXV

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THE NEW WORLD SPECIES OF SLOANEA (ELAEOCARPACEAE)

The genus *Sloanea*, assigned to the family *Elaeocarpaceae*, is one of the numerous tropical genera with representatives in both the Old World and the New World. The Old World species of *Sloanea*, with a center of diversification in Malaysia, have been recently treated in part by A. C. Smith (1944). The New World species, with a center of diversification in northern South America, were last revised in Martius' Flora Brasiliensis in 1886 by Schumann. Since Schumann's treatment, many new species have been added to the genus. The present revision will consider the systematics of the New World species of *Sloanea*, based on a study of the morphology of the plant and presented with the current knowledge of the relationships of American floras.

The family *Elaeocarpaceae* is a somewhat arbitrary assemblage of genera, mostly removed from the *Tiliaceae* because they lack the mucilage ducts common to the members of that family. Although Hutchinson (1926) retains the Elaeocarpaceous genera in the *Tiliaceae*, most authors today recognize the group as distinct from *Tiliaceae*. Some of the characters of the *Elaeocarpaceae* suggest affinities with the *Sterculiaceae*, and the *Malvaceae;* they sometimes closely resemble the *Flacourtiaceae*.[1]

Sloanea is a well-defined genus in the New World. *Muntingia*, *Vallea*, *Crinodendron*, *Dubouzetia*, and *Aristotelia*, the other American genera of the *Elaeocarpaceae*, differ markedly from *Sloanea*. As an example, the floral parts of several of these genera have a basic number of 3, while *Sloanea* is characterized by floral parts with a basic number of 4. Additional differences in foliage and in fruit may be found between *Sloanea* and the rest of the New World *Elaeocarpaceae*. The American *Sloaneae*, clearly distinct from the other New World genera of the family, are most closely related to the Old World genera *Elaeocarpus* and *Sloanea*, section *Echinocarpus*. Kukatchka and Rees (1943), from a study of wood anatomy, conclude, "*Sloanea* is undoubtedly the most primitive member of the family," and, "The wood of *Sloanea* exhibits the most primitive features of the *Elaeocarpaceae* while *Echinocarpus* shows a definite trend toward *Erinocarpus* of the *Tiliaceae*." These authors have proposed that *Echinocarpus* be elevated to generic status. They then rate *Sloa-*

[1] Approximately one third of the unidentified specimens of "Sloanea" I have examined belong to the *Flacourtiaceae*.

nea as most primitive and *Elaeocarpus* and *Echinocarpus* respectively more advanced, based on their study of wood anatomy.

The genus *Sloanea*, prior to this monograph, had become greatly enlarged by the addition of new species since the treatment by Schumann (1886). Previously, George Bentham (1861) had set up the sub-divisions of the genus on the basis of an examination of the material at his immediate disposal. These divisions have long since become obsolete with the addition of many new species. Neither Bentham nor Schumann completely resolved the several nomenclatural tangles present in their time, and the literature became considerably more involved during the 1900's, when regional or local floras emphasized the variations, often on a subspecific level, of the group within their geographic boundaries. Thus, *Sloanea* had become a much entangled skein of variable species and regional nomenclature with which neither the casual worker nor the herbarium curator could successfully cope.

My approach to the problem was entirely free of a regional bias. An attempt was made to secure authentic material representing all of the names extant in the literature. This has been largely successful, only *S. Regelii* Schum. having proven unobtainable. Careful dissections of flowers and fruits were made from all of the fertile herbarium specimens prior to any study of the nomenclature. Thereafter, all specimens were brought first into large groups, and then into smaller groups, until a satisfactory series of species could be defined, irrespective of the names on herbarium labels or in the literature. Finally, an exhaustive search was made of the literature to correlate original descriptions with authentic specimens in determining the proper names of the species. Unfortunately, time does not permit a field-study of the proposed species (a much-needed but large task in itself when the extent of the distribution and habitats of the species is considered).

Acknowledgements

It is indeed a pleasure to acknowledge the assistance and helpful criticism of Dr. Richard A. Howard who suggested the problem and guided the work in progress. Without the advice of Dr. Reed C. Rollins of the Gray Herbarium many of the perplexing problems in the genus, both nomenclatural and otherwise, would have remained unsolved. I particularly wish to thank Dr. R. C. Foster for his willing aid in nomenclature and checking Latin diagnoses. Dr. I. W. Bailey deserves thanks for his very helpful advice through the anatomical study. Miss Teresa

La Croix of the Biological Laboratories prepared the acetolated pollen-samples needed for this study. Dr. N. Y. Sandwith of the herbarium of the Royal Botanic Gardens, Kew, kindly checked on the details of Robert Schomburgk's collections of *Sloanea*. Mr. Malcolm Smith of Basseterre, St. Kitts, B. W. I., made several collections of *Sloanea* especially for me.

The curators of the following herbaria kindly permitted me to borrow specimens from the herbaria under their direction (the initials used as abbreviations are those used in the citation of specimens in the most part as suggested by Lanjouw 1939, 1941).

Arnold Arboretum, Harvard University, Jamaica Plain, Mass. (A); Instituto Agronómico do Norte, Belém, Pará, Brazil (BI); Herbario Nacional de Colombia, Instituto de Ciencias Naturales, Universidad Nacional, Bogotá, Colombia (COL); Chicago Natural History Museum, Chicago, Ill. (F); Conservatoire et Jardin botaniques, Genève, Switzerland (G); Gray Herbarium, Harvard University, Cambridge, Mass. (GH); Royal Botanic Gardens, Kew, Richmond, Surrey, England (K); Rijksherbarium, Leiden, The Netherlands (L); Missouri Botanical Garden, St. Louis, Mo. (MO); New York Botanical Garden, New York, N. Y. (NY); Muséum National d'Histoire Naturelle, Paris, France (P); Academy of Natural Sciences, Philadelphia, Pa. (PH); Jardim Botânico, Rio de Janeiro, Brazil (RB); Naturhistoriska Riksmuseet, Stockholm, Sweden (S); United States National Museum, Washington, D. C. (US); Instituto Botánico, Caracas, Venezuela (VEN).

History

Sloanea was first described by Linnaeus in Species Plantarum (1753), the descriptions of the two species being taken from Plumier and from Catesby. *S. dentata* L. remains the type of the genus today, but the first of many nomenclatural transfers into and out of *Sloanea* was necessitated by Linnaeus' unfortunate inclusion of *S. emarginata*. This species is now *Manilkara emarginata* in the *Sapotaceae*. Linnaeus placed the genus in *Polyandria Monogynia*.

Since the time of Linnaeus, some of the species have always been recognized as *Sloanea*. Divisions of the genus have been made and later reduced, or species have been proposed under new genera and then brought into *Sloanea*. One of the earliest of the segregate genera was the genus *Ablania* Aublet (1775), described from French Guiana. Aublet placed this genus in *Polyandria Digynia* of the Linnean system, without recognizing its relationship with the species of *Sloanea* he had described. In revising Genera Plantarum (ed. 8, 1789), Schreber renamed Aublet's genus *Trichocarpus*, apparently without reason, and this name was used by Willdenow (1800). It was not until 1861 that Bentham recognized the correct affinities of the genera *Ablania* and *Trichocarpus* and transferred Aublet's species to *Sloanea*.

In the meantime, Schott (1827) proposed the genus *Dasynema* for a New World species which he compared with *Ablania* and *Tetracera* (the neighboring genera under the Linnean system). Until Bentham published his treatment of the *Tiliaceae*, many American species of *Sloanea* were transferred to *Dasynema* (principally by Splitgerber and Walpers); also new species were described in *Dasynema*, leading to considerable confusion of the two groups. Although Bentham had published one species in *Dasynema*, he later recognized the inadequacy of the previous treatments and brought all of the species of *Dasynema* into *Sloanea* in 1861. Two years previous to the publication of *Dasynema*, DeCandolle (1825) had published *Lecostemon terniflorum* (from a mss. by Mociño and Sessé) as a new genus and species allied to the *Rosaceae*. The genus *Lecostemon* never became widely accepted, and the Mociño and Sessé species was relatively unknown until 1944 when Standley discovered that it was the same as a well-known Central American species, *Sloanea quadrivalvis*. Standley therefore made the transfer bringing *Lecostemon* into its proper place as a synonym of *Sloanea*. Finally, on the basis of his collections from Central America, Oersted (1853) established without description a new genus, *Lasiocarpus*, with one species *L. triflorus*. In 1857), Oersted validly published a second genus, *Dasycarpus*, with the single species *Sloanea quadrivalvis* Seem. The generic names *Lasiocarpus* and *Dasycarpus* were never widely accepted, and Seemann's species continued to be referred to *Sloanea*.

Because many of the Old World species of *Sloanea* are petaloid, have the seed only partially enveloped by the aril, and often differ in more minor characters, several additional genera have been erected to separate into distinct genera the Old World and New World species, and to divide the Old World species into several small genera. Blume (1825) proposed the genus *Echinocarpus* for a Javan species. In studying the *Tiliaceae*, Bentham found that his material from the Old World could be kept in this genus and distinguished from American *Sloanea* by the imbricate aestivation of the sepals, and by the 4 or 5 petals. Species described since Bentham's treatment make his disposition of the group unsatisfactory. Schlechter (1916) kept this genus distinct, because he felt that *Sloanea* differed in having clustered flowers, parted styles, and entire arils of the seeds. In the light of the presently known American *Sloanea*, this distinction is not tenable, as all of the conditions cited are violated many times. Additional

genera proposed among the Old World *Sloanea* include *Phoenicosperma* Miq. (1865), *Anonoides* Schlecht. (1916) and *Antholoma* Labill. (1798). The characters proposed to separate these genera from *Sloanea* were found to be totally inadequate by A. C. Smith (1944). He has, therefore, brought these concepts into *Sloanea*, often as sections of the genus. I, too, can find no characters of sufficient worth to separate the Old World species and the New World species as distinct genera.

Schumann, in his treatment of *Sloanea* in Engler and Prantl's Nat. Pflanzenfamilien, proposed to separate the genus into 3 sections, *Eusloanea*, *Echinocarpus*, and *Phoenicospermum*. This treatment is now wholly inadequate, the characters separating the groups being found in varying combinations in species of both the Old World and the New.

Morphology and Taxonomic Criteria

HABIT

All of the species of *Sloanea* now known from the New World are trees. In a few instances, collections have been made from shrubs, but these are almost certainly anomalous plants. Probably all of the shrubby plants are the direct result of damage to the plant. Wherever clearings have been made along a watercourse, or by man's agricultural activities, shrubby shoots from persistent root-systems are to be expected.

New World *Sloanea* may be roughly divided into 3 categories: (1) rain-forest trees whose crowns are in the canopy; (2) rain-forest trees which make up a portion of an understory; (3) trees of drier forest or savannah-areas with gallery-forests. Although collectors often fail to give data concerning the habit and habitat of the plants, some complete records are available, particularly for the Antillean and Central American species. Among the species in the first category are *S. Massoni* and *S. dentata* of the Lesser Antilles which are often 30 meters tall and form an important part of the forest-canopy. In some areas of the Windward and Leeward Islands, these species contribute to a forest which, as H. Stehlé (1947) says, "décrite par le plupart des botanistes et forestiers comme communauté à *Dacroydes-Sloanea*." *S. medusula* of Central America is also a species of the forest-canopy, but it may persist as a smaller tree in cleared areas. Presumably, many of the large Sloaneas of the Guianas and the Amazon basin are also trees of the forest-canopy.

S. trichosticha from Trinidad and continental South America clearly belongs in the second category. *S. guianensis* and many of the other *Sloanea* species may occur as understory trees rather than components of the forest-canopy.

Finally, *S. multiflora* of the Colombian llanos and *S. curatellifolia* from the forests of Cuba are trees of gallery-forests or drier evergreen forests. The species of *Sloanea* found in southeastern Brazil (*S. monosperma* and *S. lasiocoma*) should perhaps be included in this group.

FOLIAGE

The leaves of *Sloanea* are simple and pinnately veined, and may be borne either alternately or oppositely on the axis. In a few species, the leaves are crowded toward the ends of the twigs. This is particularly true of *S. rufa*, *S. granulosa*, *S. brevipes*, and *S. spathulata*. Coincident with this crowded arrangement, there seems to be a more heavily developed indument.

STIPULES

All of the American species bear a pair of stipules laterally on the stem at the base of the petiole, at least when the leaves are developing. Within the subgenus *Sloanea*, the stipules usually persist until the leaf is well developed; in section *Sloanea*, stipules are generally found with the three or four most recently developed leaves. While stipules are present in the subgenus *Quadrisepala* at the terminal bud, they generally are deciduous before the leaf which they accompany develops.

Stipules vary greatly in size, shape, and indument, within the American species. Generally, the stipules are relatively inconspicuous, ovate, deltoid, lanceolate or linear, and covered with a fine pubescence. In section *Sloanea*, the stipules are often prominent, many are navicular, and their margin may be entire, dentate, serrate or lacerate. The lanceolate, serrate-margined stipules of *S. dentata* are distinctive. In *S. medusula*, the stipules are large, leaf-like organs which may be as long as or longer than the succeeding internode, and they bear a line of dense pubescence along the center of the stipule. Where the stipules are large and navicular, as in *S. grandiflora*, they may become inhabited by a colony of ants, although there is no apparent specialization for use as domatia. The type-specimen of *S. fragrans* from Bolivia bears stipules which are up to 13 cm. long, strongly veined and leaf-like. The lanceolate, leaf-like stipules of *S. lanceolata* are distinctive of that species.

In section *Brevispicae*, the stipules are caducous, being present only on the younger twigs. Although the same types of variation may be found in this section as are seen in section *Sloanea*, none of the species of this group bear very large stipules. In general, stipules of species in this section are deltoid to lanceolate and uniformly covered with a fine pubescence.

The subgenus *Quadrisepala* is made up of species which drop their stipules before the development of the leaves in the terminal bud. When stipules can be found in this group, they are generally ovate to lanceolate and often puberulent.

PETIOLE

The shape in cross-section of the petiole of species of *Sloanea* appears to be relatively constant; however, the size and indument vary widely. This variation may be due, in part, to age-differences. Petioles of many species tend to lose at least a part of their pubescence as they mature, and they often become thicker and longer. In cross-section, the petioles are terete or canaliculate to varying degrees. Although they are often striate, they are seldom angular. Most of the petioles of the American species are incrassate at one or both ends, often conspicuously so. In a few of the species of section *Sloanea* (*S. multiflora*, *S. macrophylla*, *S. grandiflora*), the swelling at the base of the leaf-blade is often concave on the underside. The soft swelling at the base of the leaf-blade in these species may act as a pulvinus when the leaf is young. In *S. macrophylla*, the petiole of mature leaves is much elongated. Throughout the genus, where the mature foliage is large, continued growth of the petiole appears to take place even after the leaf-blade has reached maximum size.

LEAF-BLADE

The lamina varies widely from species to species, and within specimens of the same species. A few species (*S. picapica*, *S. monosperma*, *S. lasiocoma*) bear leaves of approximately the same size and shape in all of the specimens which I have seen. These are unusual in this respect. Where a number of collections have been seen, as in *S. guianensis*, there appears to be a correlation between geographic area and leaf-shape. In this species, for example, the collections from the Guiana region possess leaves which are elliptical and nearly entire-margined. To the south, in Bolivia, the marginal dentation of the blade is strongly pronounced, while southeastward in Brazil the foliage of *S. guianensis* is broader and the margins are distinctly undulate.

Both *S. dentata* and *S. Massoni* produce leaves in two size-classes. The normal foliage of these two species varies widely in size and shape. In addition, larger leaves are produced on saplings and adventitious shoots. Mr. Malcolm Smith, who very generously collected material for me of two species on St. Kitts, writes, "The large leaf is found on both trees, but only at the ends of new branches and the tops of young trees. The normal size is more like the leaves on the Belmont specimen" (a normal fruiting branch of *S. Massoni*). The adventitious foliage of *S. dentata* which Mr. Smith sent me includes one leaf which measures 27 inches in length, 16 inches in width, and is borne on a petiole 7 inches long, in contrast to average and normal leaves with blades 8½ x 15½ inches on petioles 3 inches long. From the herbarium-material which I have seen, I suspect that many *Sloanea* species in the Americas produce similarly larger foliage on adventitious shoots. This material does not appear in the herbarium, and the botanist often may not mention such foliage in his collection-notes.

Leaf-venation throughout the group studied is pinnate. The secondary veins are usually straight in small leaves, arcuate in large leaves. In a few species (*S. multiflora*, among others) the secondary veins are often strongly arcuate at the margins. Although the number of secondary veins in the leaf-blades of any one species has often been emphasized, the number of secondaries appears to be a function of the size of the leaf and does not constitute a diagnostic character except within very broad limits. Only in the few species mentioned with relatively uniform foliage would the number of secondary veins be of more than passing importance. While the venation on the upper surface of the blade is usually impressed in the New World species, in some the venation is prominently raised. All of the species described here have more or less prominent veins on the under side of the lamina. In *S. zuliaensis*, particularly, the midrib is so deeply undercut next to the blade that it appears almost completely terete on the under side. Where pubescence is present on the leaves, it is generally restricted to the veins and venules. *S. Eichleri* is a notable exception to this, the entire lower leaf-surface being densely pubescent.

Leaf-margins vary from entire to sharply dentate, often within the same species. *S. ilicifolia* is notable in that the veins and midrib terminate in sharp spines at the margin. This is the only American *Sloanea* with spinose-dentate leaf-margins, and

this condition is found in none of the Old World species which I have seen.

INFLORESCENCES

Basically, inflorescences in New World species of *Sloanea* are paniculate or racemose, but numerous variations occur. Subgenus *Sloanea* has racemose inflorescences throughout. *S. zuliaensis* of section *Sloanea* bears cymosely arranged pedicels at the ends of the branches of the raceme (Plate 1-G). Subgenus *Quadrisepala* may be readily divided into section *Paniculi* with paniculate inflorescences which are often much branched, and section *Corymbo-racemi* in which the inflorescences vary from nearly corymbose in *S. nitida* to various degrees of corymbo-racemose inflorescences in species such as *S. laurifolia* (Plate 1-E) to entirely racemose inflorescences.

The inflorescences are generally borne in the axil of a leaf or leaf-scar. In subgenus *Sloanea*, the inflorescences are often partially hidden in the foliage. In section *Paniculi*, however, the strong development of primary peduncles often elevates the inflorescence above the leaves. Occasional terminal inflorescences are found in the latter section, but they are the exception rather than the rule.

Occasional evidence has been seen of continued growth of the inflorescence to produce a leaf-bearing twig. A collection of twigs from a tree in partially cleared land consists only of inflorescences in which the bracts are developed into large foliar organs and the axis has continued to elongate, making the specimen appear to be a distinct entity which often bears a single flower in the "leaf" axil. This collection is clearly an anomalous collection of *S. medusula*. Rarely, one or several bracts of an inflorescence may become leaf-like without an accompanying elongation of the axis.

In most of the New World Sloaneas, the peduncles, pedicels and persistent bracts, are pubescent to a greater or lesser extent. All of the indument appears to be simple trichomes with very heavy walls and narrow lumens, often filled with tannin or other dark material (Plate 3-H). Attachment of the trichomes is not unusual except in *S. Tuerckheimii*, in which the trichomes grow out from a basal ring of cells (Plate 3-G).

In section *Paniculi*, the peduncle and pedicels are often thickened and angular. In many species, the branches of the inflorescence taper upward, and in a few species the pedicels are markedly flared immediately beneath the sepals. While the

enlarged receptacular surface generally has a greater diameter than the apex of the supporting pedicel, in *S. Schomburgkii* the pedicel often exceeds in diameter the receptacular surface.

While most species of *Sloanea* in America bear 5 or more flowers in an inflorescence, there is a tendency for reduction of flower-number which is carried to the extreme in section *Corymbo-racemi*. *S. lasiocoma* and *S. jamaicensis*, without exception, bear only one flower in an inflorescence, while *S. monosperma* and *S. amygdalina* often bear single-flowered inflorescences as well as two- or three-flowered inflorescences.

In subgenus *Sloanea*, the bracts are usually persistent, at least subtending the pedicels. With the exceptions noted, they are non-foliaceous, and vary widely in shape and size within a given species. While bracts are usually simple, in *S. curatellifolia*, particularly, they are tripartite, consisting of a large central bract with two narrower lateral bracts (Plate 1-I). These extra portions apparently are the equivalent of the persistent stipules found with the foliage in section *Sloanea*. Mostly, the bract-margins are entire, but in some instances the bracts may be two- or three-toothed at the apex, or the margin may be strongly dentate. Indument generally covers the entire bract. It may be more dense on the abaxial surface. In *S. medusula*, where the bracts are noticeably large, the pubescence is generally restricted to the midline of the bract.

FLOWERS

Flowers in the New World *Sloanea* species are usually borne 5 or more in an inflorescence.

SEPALS

The perianth is a single whorl of sepals (with one exception, *S. jamaicensis*) and the essential organs consist of innumerable stamens and a compound pistil with 3 to 6 locules borne in the same flower.

The condition of the sepals in the bud provides the basis for separating the American species into two subgenera. Subgenus *Sloanea* is characterized by 4 to 9 sepals which do not cover the essential organs before maturation of the flower. In subgenus *Quadrisepala*, the 4 (rarely 3 or 5) sepals form a closed bud with the essential parts entirely covered until anthesis.

Within the first group, sepals are variable in number, size and shape within the same species and within the same collection (Plate 1-I). While the majority of the species have entire

sepals, occasional flowers may be found with sepals 2- or 3-toothed at the apex. Indument varies from collection to collection, but, when present, is always of simple trichomes. In *S. obtusifolia*, the 4 or 5 sepals are united at the base; in *S. grandiflora* (Plate 1-H) the calyx is cyathiform with lobed margins, and the calyx of *S. zuliaensis* consists only of a lobed disc.

The 4 sepals of the flower in subgenus *Quadrisepala* are often thickened, and, in section *Paniculi* particularly, the sepal-margins are thickened so as to form a ridge in the bud. (Plate 1-A). The sepals in this subgenus usually are uniform in size and shape. Indument, when present, consists only of simple trichomes. The sepals of *S. nitida* are petaloid in appearance, and the presence of large bracts immediately beneath the flower in some collections of this species leads to speculation as to the ultimate effect of inflorescence-reduction in the group. *S. jamaicensis*, with its anomalous flowers bearing two whorls of perianth-parts of four members each, has apparently evolved from a species similar to *S. nitida*. In *S. jamaicensis*, the outer whorl is sepaloid and has been called "sepals"; the inner whorl is petaloid and has been termed "petals." (Plate 1-C). I believe that the inner whorl represents the true sepals, and the outer whorl represents two sets of bracts at right angles brought into the flower by the reduction of a complex inflorescence. This species seems in no way closely related to the petaliferous Old World species of *Sloanea* from Indo-Malaysia and Australia.

RECEPTACLE

The essential organs are borne on an enlarged receptacle-surface which is densely velutinous, pubescent, or, rarely, hirsute. After the dehiscence of the stamens, numerous pits in the receptacular surface mark their former position. Although most of the receptacles in American *Sloanea* are not notably distinct from species to species, there are occasional characters which may be fairly reliable, such as the very irregular margin in a few species, and the corrugated margin in *S. amygdalina* and closely related species in section *Corymbo-racemi*. I have already mentioned the receptacle of *S. Schomburgkii* which often has a lesser diameter than the pedicel on which it is borne.

Sloanea multiflora was described as bearing white "glands" at the base of the ovary. I find that the white "glands" from the specimen from Karsten's herbarium are hymenopterous larvae. Although the enlarged receptacle of *Sloanea* has been called a disc, it bears no glandular tissue, and I feel that there is no reason

for designating the structure as anything more than receptacular tissue.

ANDROECIUM

Stamens in New World *Sloanea* species constitute one of the most stable organs in size, shape, and indument, and, thus, become significantly important in species-diagnosis. Stamens may vary in number in flowers of different species. Small-flowered species (*S. meianthera*) bear relatively few stamens (about 50) while large-flowered species (*S. synandra*, *S. medusula*) bear well over 100 stamens closely packed in the flower. Stamen-number has no more than general significance within the American *Sloaneae*.

The filament of the stamen may be filiform or thick. When it is thick, it may be angled or laterally flattened. The latter condition is found principally in the larger-flowered species of sections *Sloanea* and *Paniculi*. The filiform filaments may be tapered from the base (*S. porphyrocarpa*) or from the apex (*S. faginea*), but their diameter is usually uniform from base to apex. In either group, indument may be lacking, or the filaments may be velutinous, puberulent, pubescent, or, occasionally, hirsute.

The connective between the anther-sacs generally bears the same indument as the filament. While it is generally narrow, in some species (*S. pubescens*, *S. durissima*) the connective is broad on the abaxial side and may be dark in color. In *S. durissima* and *S. synandra* particularly, the connective is grooved so that the stamens interlock to a considerable extent.

The anthers may be short and ellipsoidal, or ovoid, or they may be elongated to various degrees. In many of the species of section *Paniculi* the anthers occupy most of the length of the stamens, are narrow, and dehisce through an apical pore. Anther-sacs in subgenus *Sloanea* generally dehisce their entire length (Plate 1-I), while in section *Corymbo-racemi* dehiscence may be either apical or throughout most of the length of the anther-sacs. In *S. laurifolia*, the dehiscence of the anther varies from a lenticular apical pore to a slit almost the entire length of the anther.

Pollen samples of American *Sloaneae* have been prepared for study by acetolysis and by lacto-phenol and methylene blue. In all of the species investigated, the pollen is globose or ellipsoidal, tricolporate, and devoid of any exine-sculpturing or markings. In large grains such as those of *S. jamaicensis* there may be a slight equatorial bulge. Size varies from 13.65 microns to 21.37 microns as recorded for the diameter and long axis.

COMPARISON OF POLLEN SIZES IN MICRONS OF REPRESENTATIVE SPECIES OF SLOANEA

	largest	*smallest*	*average*
Subgenus Sloanea			
Sect. 1. Brevispicae			
S. guianensis	16.5	12.0	14.06
S. meianthera	18.5	12.0	15.48
S. granulosa	15.0	10.5	13.65
Sect. 2. Sloanea			
S. medusula	21.0	16.5	18.78
S. dentata	16.5	12.75	14.58
S. zuliaensis	16.5	12.75	14.63
Subgenus Quadrisepala			
Sect. 3. Paniculi			
S. laurifolia	21.75	18.75	21.37
Sect. 4. Corymbo-racemi			
S. jamaicensis	21.75	19.50	21.03
S. Berteriana	16.5	12.0	14.96

The connective in the New World species of the genus is always continued into a process beyond the anther-sacs. While this may be only a small knob, it is often continued into a thick, obtuse awn, terete in section, and usually glabrous or only minutely puberulent. In *S. rufa*, *S. Duckei*, and *S. Garckeana*, the awn is a long filiform appendage. Within section *Sloanea* (*S. macrophylla*, *S. multiflora*, *S. grandiflora*), the awn is laterally flattened, and, in the immature flower, the awns closely overlap, covering the anthers tightly. At anthesis, these stamens separate from one another, so that the adherent character is of little significance in this group. *S. zuliaensis* has awns which are remarkably truncate, and the stamens are packed into a close globose mass so that the awns form a mosaic-like surface to the ball through which the style projects at the top.

GYNOECIUM

Pistil-characters are also markedly uniform within the species in the New World Sloaneas. The ovary is 3- to 6-loculed (most commonly 4-loculed) and the axial placenta supports about 8 to 10 ovules in two rows per locule. Szyszylowicz (1885) states, "Letztere (ovulis) sind anatrop hängend, mit einer ventralen raphe; die Mikropyle nach oben und aussen gerichtet." I have found no variation from this condition.

Externally, the ovary may be smoothly globose, ovoid, or obovoid, or it may be more or less angled. *S. mexicana* bears an ovary which is distinctly ridged. Indument consists of simple,

thick-walled trichomes (Plate 3-H). The ovary may be densely puberulent to occasionally hirsute, but never glabrous.

The style may arise gradually from the apex of the ovary, in which case it is distinctly tapered, or it may arise abruptly and be about equal in diameter throughout its length. *S. caribaea* bears a style which is usually distinctively obclavate. The apex of the style may be entire, or parted into the same number of branches as there are locules in the ovary. Occasionally, the style may be parted almost to the ovary. In *S. Massoni*, *S. curatellifolia* (Plate1-I), and *S. ilicifolia*, the style is sometimes bipartite almost to the ovary, each section being parted again only at the apex. The style is usually angled and may be either straight or twisted within the same collection. Ordinarily, only the basal portion of the style bears indument, the apical portion being glabrous, although in a few species, the style is pubescent throughout its length.

FRUIT

The fruits of the New World species of *Sloanea* are loculicidally dehiscent capsules (Plate 2). The capsule may be globose, ellipsoid or ovoid. In some species, calyx and receptacle persist at the base of the fruit. The majority of species bear armed capsules ornamented with stout spines, soft spines or small irritant spines. Only a few species in subgenus *Quadrisepala* (*S. lasiocarpa*, *S. synandra*, *S. Schomburgkii*, *S. laurifolia*, *S. Berteriana*, *S. grossa*) bear unarmed capsules, while others (*S. latifolia*, *S. caribaea*, *S. Fendleriana*) have capsules unarmed or with scattered short prickles. The only completely unarmed capsule in subgenus *Sloanea* is that of *S. granulosa*.

Capsules bearing spines may be divided into two major groups on the morphology of the spines: (1) the largest number bear spines which are unequal in length, usually taper from the base, may be rigid or semi-flexible, and do not give the impression of being very densely crowded except in *S. grandiflora*. The capsular spines of *S. grandiflora* are flexible, curled, and form a dense mass on the capsule-surface (Plate 2-I). (2). The other group bears spines which are about equal in length, are often clavate, flexible, densely crowded and are easily detached from the capsule. These spines are irritant, piercing the skin easily, and are difficult to extract (Plates 2-G, 3-F). *S. brevispina*, *S. porphyrocarpa*, *S. Garckeana*, *S. amygdalina* and *S. monosperma* belong to this last group.

The first group may be divided again into those species with small capsules with semi-flexible spines which do not noticeably taper (Plate 2-E, H). *S. meianthera* and *S. guianensis* are examples of this type. The other extreme of capsule-development in the group is species such as *S. durissima* and *S. echinocarpa* with stout, tapered spines which are rigid (Plate 2-C).

Most of the spines of *Sloanea* capsules bear some form of indument. The spines in the first group vary from scattered-puberulent to hispid. The last group, with irritant spines, usually bears flattened shining trichomes which are often more numerous and longer at the apex of the spine.

The ovary of *Sloanea* at anthesis usually shows no sign of spine-development. Soon after fertilization, spines begin to appear among the hairs clothing the ovary, and grow rapidly as the fruit approaches maturity. These processes are apparently of epidermal or sub-epidermal origin.

The valves of the capsules are usually rigid. A few species are characterized by very woody valves. The capsule of *S. dentata* may approach an overall diameter of 3 inches, and the valves may be as much as ½ an inch thick (Plate 2-F). The largest capsule is borne by *S. jamaicensis*, but the valves of this capsule are only about ¼ of an inch thick (Plate 2-D).

Dehiscence is generally from the apex, the capsules opening only far enough to disclose the seeds in some species, or the valves becoming completely reflexed in others.

SEED

Each capsule bears only one or two seeds (occasionally 3) in the New World *Sloaneae*. These are attached by the funiculus to the apex of the capsule. The seeds bear a raphe which may be prominent. All of the American species of which I have seed-material bear an aril except *S. paruiflora*. The aril grows from the chalazal end of the seed, to which it is firmly attached, and may cover only one-half of the seed as in *S. latifolia*, or almost completely cover the seed as in most of the species. The margin of the aril may be variously lobed, and the margins of the lobes may be irregular or lacerate, or entire. The testa of the seed is usually thin. The embryo is straight with large, flat cotyledons, and is enveloped within abundant endosperm. In *S. latifolia*, the funiculus and placenta enlarge so that the tissue forms a separate process extending upward around the seed from the base of the capsule. This often remains in the capsule after the seed is removed.

Anatomy

WOOD

The twigs of *Sloanea* show in cross-section a large central mass of pith into which project numerous points of primary xylem. The primary xylem is normal in appearance with scattered vessel-elements. The succeeding metaxylem is notable for the absence of vessel-elements. Thereafter, the secondary xylem is laid down with vessels regularly interspersed with rays of two size-classes and many fiber-cells and wood-parenchyma. As the twig matures the metaxylem is broken down to leave a ring of canals just outside of the primary xylem. Dr. I. W. Bailey studied this material and felt that the canals were lysigenous in formation rather than schizogenous. Within the node, the leaf-vascularization arises with three gaps as a trilacunar trace, which shows a particularly wide center gap in the twig section of *S. dentata.*

Most of the available label-data on the wood of *Sloanea* suggests that many of the species have fairly dense, hard wood. However, the only published description of the wood of an American *Sloanea* species is that of *S. grandiflora* (as *S. Linderi*). Kribs (1928) describes this wood as "light and soft." Having examined sections of the sample which Kribs examined and compared them with sections of *S. megaphylla* (the only other wood-sections of an American species available to me), I believe that the former sample represents adventitious wood. The latter sections show a more compact wood with smaller cells throughout and an absence of parenchyma, although the two collections are similar in all other details.

FOLIAGE

For the study of the leaf-anatomy, dried leaves from herbarium-specimens were boiled until soft. Petioles were hand-sectioned serially and stained with phloroglucinol and fast-green before mounting in glycerine. From the lamina, a rectangular piece was removed about midway between the base and the apex of the leaf and midway between the midrib and margin of the leaf, avoiding the heavy secondary veins. These were sectioned by hand with a razor blade as they were held between celloidin blocks and the resulting cross-sections were mounted in glycerine. Epidermal sections from both the upper and lower epidermis were included in each preparation.

PETIOLE

The vascular bundles of the petiole enter the base of the petiole as three strands which quickly unite into a ring; this continues through the petiole to the apex where division of the strands takes place and the ring becomes much broken. Where an area of soft tissue occurs at the base of the leaf-blade (see discussion of petiolar morphology) numerous small bundles traverse an area of parenchymatous tissue without any marked specialization. Frequently, the traces which are going to supply the lowermost pair of secondary veins in the lamina can be readily differentiated near the apex of the petiole. The ring of vascular traces is jacketed by sclereids on the outside. Next to the outer jacket the remains of crushed phloem persist as darkened masses of tissue, and the individual traces are separated from each other and from the pith by more sclereids. Within the pith, additional bundles, again with jacketing sclereids and crushed phloem, are present either as arcs (many of the species) or as individual bundles (*S. granulosa*, *S. grandiflora*). When the petiole is canaliculate (*S. Tuerckheimii*, *S. spathulata*), there are often two additional traces outside of the ring in the ridges along the top of the petiole. Outside of the ring of traces, the cortex is usually relatively wide, and consists of a homogeneous layer of parenchyma-cells. Occasionally, the cortex may be extremely narrow as in *S. zuliaensis*, or it may be prominently divided into an inner layer of parenchyma and an outer layer of collenchyma (*S. obtusifolia*). The outermost rows of cells of the petiole are heavily cutinized. In *S. Schomburgkii* and *S. brevispina*, heavy cutinization or lignification of the petiole extends through the cortex to the sclereid jacket. The former species shows a ring of traces which is prominently broken. Occasionally, lacunae have been observed in the petioles, associated principally with the vascular tissue within the pith. In *S. grandiflora*, lacunae occur in the area of crushed phloem and are probably schizogenous in formation. Irregular lacunae in *S. guianensis*, *S. granulosa*, *S. Tuerckheimii* and other species may be associated either with the primary xylem-tissue or with the pith. These also are perhaps schizogenous. Where metaxylem occurs in the ring of traces in *S. zuliaensis*, regular, circular canals are found which appear to be lysigenous in formation.

LEAF-BLADE

The leaf-blade of the New World species of *Sloanea* is composed of a thin to very heavy upper cuticle, usually a single layer of upper epidermis (with angular cells of uniform depth and without

stomata), a layer of palisade parenchyma, irregularly organized spongy mesophyll, a single layer of lower epidermis, and the lower cuticle which is about the same thickness as the upper cuticle. The cells of the upper epidermis are angular, regularly uniform in size and wall-thickness. The palisade mesophyll cells are elongate, thin-walled cells uniform in size. The spongy mesophyll varies greatly. Cells of the lower epidermis are uniform in depth, but often irregular in size and shape. They are usually somewhat angled. Vascular bundles are bicollateral. Even the smallest bundles are surrounded by thick-walled sclereids which extend above and below the bundle to the epidermis. Stomata occur only on the lower surface of the leaf where they are numerous. All of the species examined had only stomata of the rubiaceous or paracytic type (type C of Metcalfe and Chalk (1950)). The small guard-cells are closely bordered by a single pair of accessory-cells which lie parallel to the long axis of the stomata.

Numerous variations of the basic leaf-structure have been found in the species examined. One of the most commonly found structural differences is the development of a second layer of palisade parenchyma next to the lower epidermis. In addition, an upper palisade parenchyma of 2 or 3 rows of cells is not uncommon (*S. picapica*, *S. obtusifolia*). Where the leaf-blade is thickened, there is usually a double epidermis both on the upper and lower surface of the leaf. Inasmuch as the inner layer is apparently not the result of a lateral division of the outer epidermis, it is perhaps more properly a hypoderm layer (*S. Schomburgkii*, *S. obtusifolia*). Often the cuticle is very thick. When only a normal thickness of cutin covers the lower leaf-surface, a slit in the cuticle occurs over the stoma. However, when the cutin is much thickened, a chamber in the cutin over the stoma opens both to the outside and into the stoma through slits (*S. Schomburgkii*, *S. monosperma*). Occasionally (*S. picapica*, *S. Schomburgkii*), the spongy mesophyll is regularly storied and often much reduced. Where numerous veins with their heavy sclereid jackets are present (*S. obtusifolia*) the photosynthetic area of the leaf is drastically reduced. It is perhaps significant that the plastids of *S. monosperma*, *S. Garckeana*, *S. terniflora* and other members of the section *Corymbo-racemi* are apparently little changed in drying, and the chlorophyll retains its bright-green color in the dried leaves of the specimens for many years.

Cellular inclusions are often present. *S. monosperma* particularly shows the development of large rhombic crystals and

druses in the jacket sclereids. In *S. picapica*, the spongy parenchyma has markedly granular cytoplasm, probably the result of a heavy concentration of colloids which persist as globules of material in the dried leaf-tissue.

VASCULARIZATION OF THE INFLORESCENCE

In order to study the vascularization, inflorescences removed from herbarium-sheets were softened by boiling. If the tissue was thick, the entire inflorescence was placed in strong potassium hydroxide solution (6 to 9 pellets of the dry chemical to an ounce of water) and kept at a temperature of 58° C. for 24 to 48 hours depending upon the thickness of the pedicels and receptacles. Thin tissue and thicker specimens previously treated as above were then placed in 3% hydrogen peroxide made alkaline with 30% ammonium hydroxide until they were completely clear (24 to 48 hours usually). The specimens were then rinsed in clear water 2 or 3 times and placed in 25% ethyl alcohol made decidedly red with an aqueous solution of basic fuchsin. Specimens removed from the peroxide clearing solution with or without rinsing and put directly into basic fuchsin did not stain properly. After about an hour in 25% alcohol and stain, the specimens were completely dehydrated through a series of 50%, 95% and 100% ethyl alcohol, and were then placed in toluol for final clearing and storage. This modified technique accomplishes clearing of thick tissue much more rapidly than either potassium or sodium hydroxide or peroxide alone. The final specimens are firm, well-stained, and easily dissected for examination.

Within the peduncle of the inflorescence, the vascular cylinder consists of many individual traces. Slightly below the insertion of a pedicel, several strands become detached from the cylinder immediately beneath the branch and enter the pedicel at an abrupt angle. Only when the species bears large bracts are the bracts supplied with a trace; species with small bracts show no vascularization in the bracts. The cylinder of vascular strands in the pedicel continues uninterrupted until immediately beneath the flower when traces become detached outwardly to provide 1 to 3 traces (usually) for each sepal in the calyx, and traces are detached inwardly to furnish two strands of vascular tissue for each carpel of the pistil. The remaining strands of the cylinder enter the receptacle where they undergo a series of dichotomies to provide a vascular trace for each of the numerous stamens (Plate 3-D).

Within the sepal, when the sepal is wide as in subgenus *Quadrisepala*, the central trace continues to the apex; the side traces usually extend laterally at the base of the sepal, dividing into two traces which extend upward. Thus, each sepal is provided with 5 main vascular traces. There may be only three strands (there being no division of the lateral traces) or only one trace in small sepals. The single trace entering the filament of the stamen continues uninterrupted through the connective and into the awn (when one is present) to the very apex (Plate 3-B, E.) The vascular tissue of the pistil, after meeting at the center of the receptacle, separates into two series. The outer series becomes diverted away from the center to provide a single strand per carpel which rises through the ovary wall. The inner series of traces (apparently one per carpel) continues up the axis of the ovary where they may diverge slightly to form shallow loops near the apex (the placenta). Here a single branch runs through the funiculus of each ovule (Plate 3-A). The main traces again come to the center at the apex of the ovary and continue upward to the apex of the style (Plate 3-B).

Distribution

New World *Sloaneae* are principally trees of rain-forest habitats from southern Mexico southward to Ecuador on the Pacific side of the Andes, and to Bolivia and southeastern Brazil east of the Andes. Species are known from all of the Antillean islands with sufficient land-area to support a moist forest.

Three major patterns of distribution are apparent. The Central American species form one group, the Antillean species form a second group, and the South American species form the third group. In addition, a few species are restricted to two areas in South America, one group in southeastern Brazil, and the other in Colombia and Venezuela in northwestern South America.

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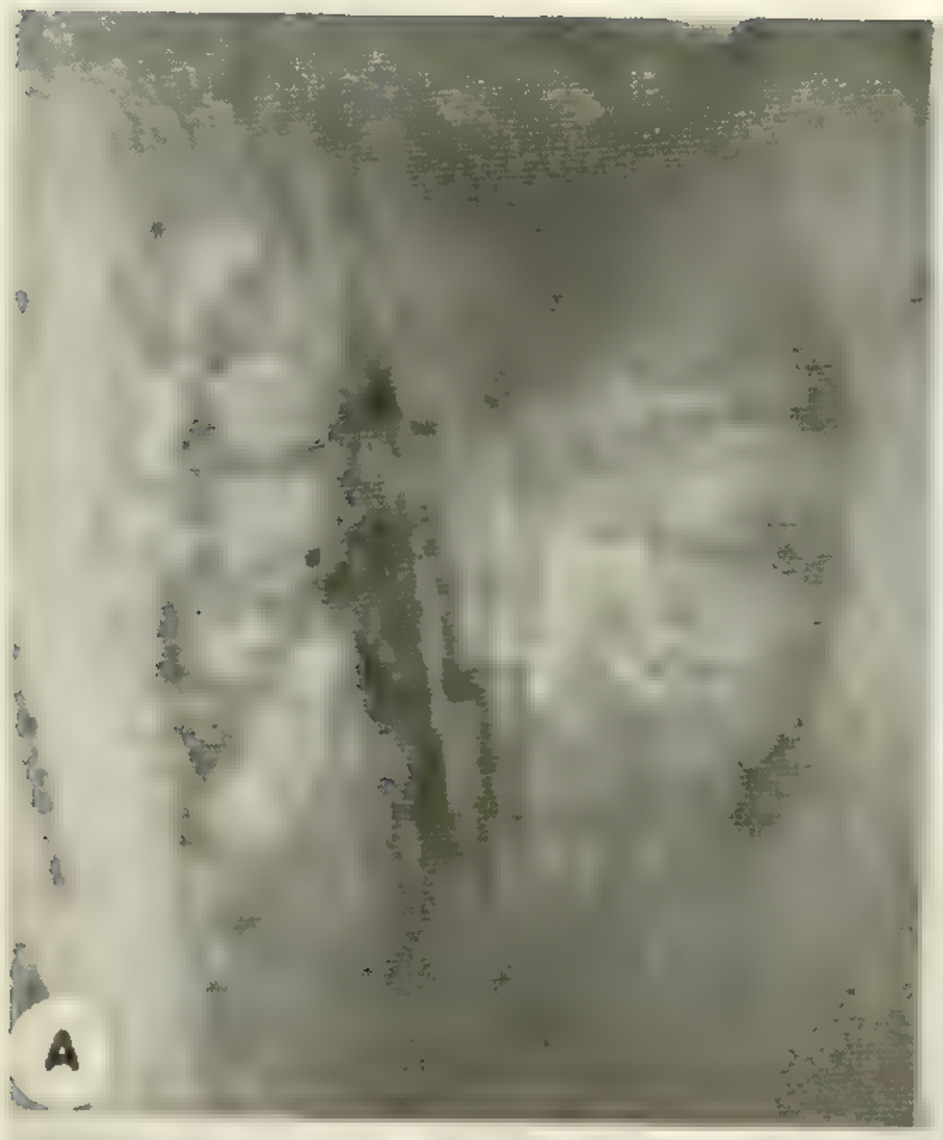
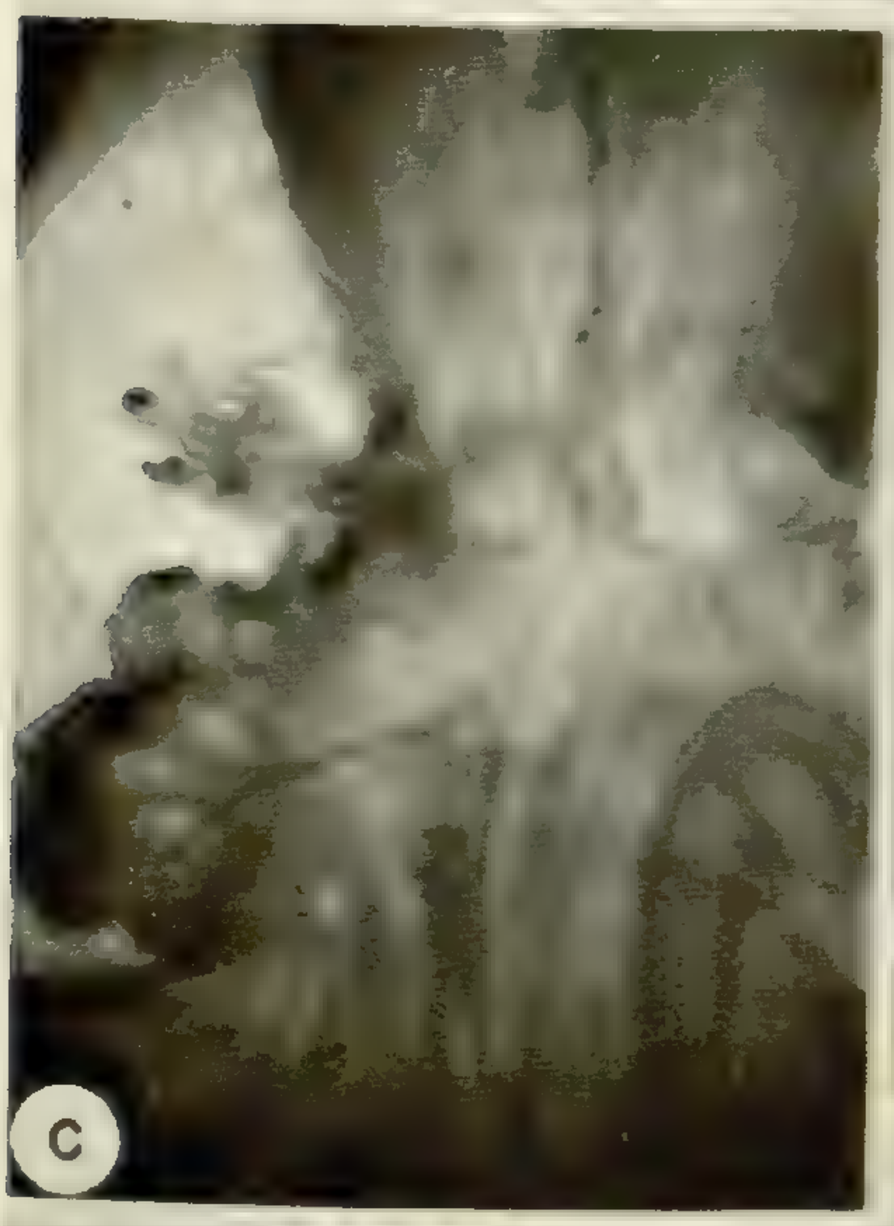
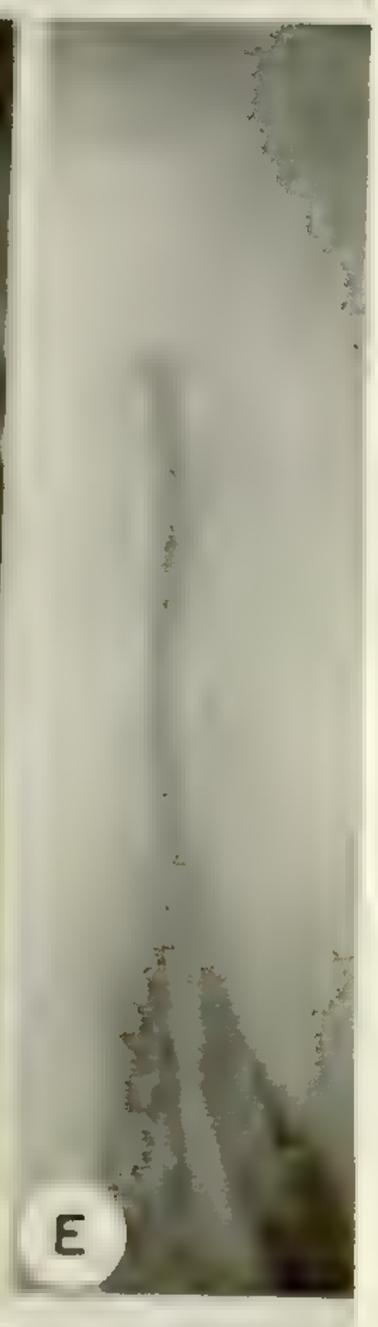
to the tip of each style-arm. c. Vascularization from the pedicel divides in the receptacle giving rise to the strands which supply the ovary (center), and, by numerous dichotomies, to a single strand for each of the numerous stamens (left). D. Numerous dichotomies of the vascular bundles from a complex network of vascular tissue in the receptacle. E. The vascular bundle rises to the tip of the awn in the stamen. Preparations cleared and stained with basic fuchsin. A. through D. photographed under low power, E. under high dry. F. Flat trichomes on the irritant spine of *S. monosperma*. G. Base of a trichome of *S. Tuerckheimii* showing the ring of cells at the base. H. Thickened trichome common to all of the American species of *Sloanea*. Photographs F. through H. under high, dry objective.







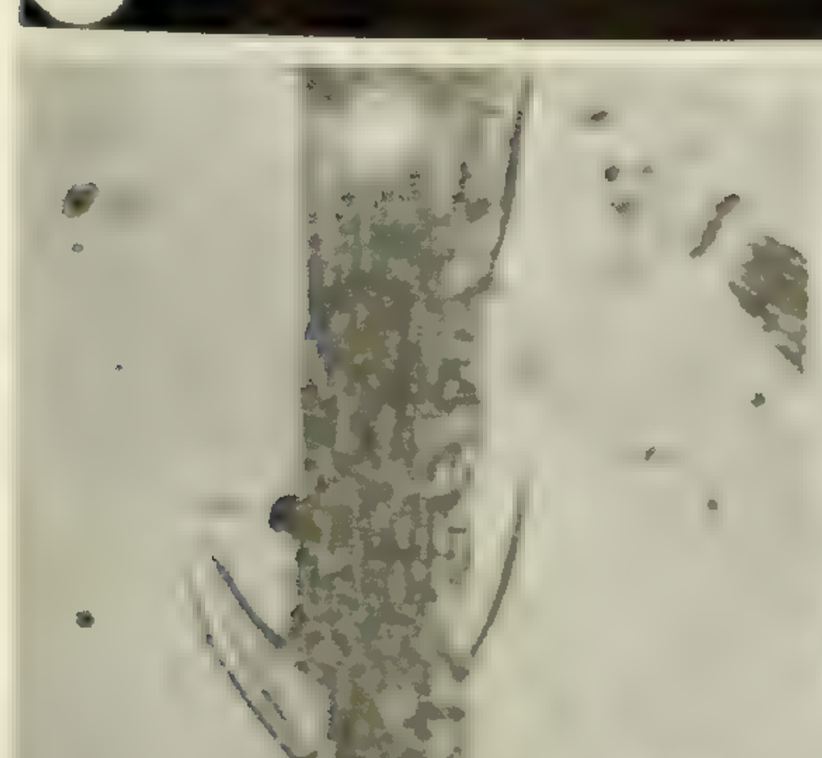


PLATE 3. ANATOMICAL DETAILS OF NEW WORLD SPECIES OF SLOANEA. A. A single vascular strand from the placenta (center) supplies each ovule. B. A single vascular bundle rises to the tip of the stamen, usually 2 or 3 bundles

Within the group of Central American species, most of the collections are from Guatemala southward through Costa Rica (Maps 1, 4, 7, 9, 10). The species in this area belong principally to sections *Brevispicae* and *Sloanea*. *S. mexicana* is known only from a single collection from the Michoacán-Guerrero region of Mexico. *S. Tuerckheimii* and *S. terniflora* have also been collected in Mexico. As yet *S. faginea*, *S. guapilensis* and *S. megaphylla* are known only from Central America, the first two principally from Costa Rica, the last from Panama. Most of the Central American species have an extension of range into South America. *S. Tuerckheimii* has been collected well over into the Guianas; *S. picapica* is known from British Honduras and Venezuela; and *S. medusula* and *S. zuliaensis* have been collected in Colombia and Venezuela respectively. While this pattern of distribution has not been previously recognized in *Sloanea*, it has been evident in other genera and families. In writing on the *Melastomaceae* of Central America, Gleason (1933) says, "More noteworthy is the presence in Central America of nine species of very broad distribution through the American tropics, and of four species heretofore considered restricted to the Amazonian forests." It is to be expected that there will be further extensions of range of South American species into Central America as more thorough collections are made.

The second group of species from the West Indies is composed of species belonging to each of the four sections of the New World Sloaneas. The pattern of distribution here is similiar to that shown by the other groups in the area (Maps 3, 4, 6, 8, 10). A few species are restricted in their ranges to the northernmost islands. *S. jamaicensis* is known only from Jamaica, *S. curatellifolia* only from the Oriente region of Cuba, and *S. ilicifolia* only from Hispaniola. The latter two species are probably related to *S. Massoni* which has been collected on the larger islands throughout the Lesser Antilles. *S. amygdalina* is restricted to the Greater Antilles, and *S. dentata* to the larger islands of the Lesser Antilles. *S. Dussii* is known only from the type-collection from Martinique. *S. Berteriana* has been collected on Puerto Rico as well as in the Lesser islands. Trinidad and Tobago show a greater affinity with the mainland, *S. stipitata*, *S. trichosticha*, and *S. laurifolia* having been collected there. *S. caribaea* of section *Paniculi* has a much wider range, extending through the Lesser Antilles, appearing in the coastal area of Venezuela, and it is now known from the upper Amazon basin in Colombia and

along the main Amazon drainage at São Paulo de Olivença. This is not unusual as the species most closely related to *S. Massoni* and *S. dentata* are found in the Guianas and the Amazon basin, and the species most nearly related to *S. Berteriana* is found in Venezuela and the upper Amazon drainage.

The largest number of American species of *Sloanea* belongs to the area of the Guianas and the Amazon and Orinoco drainage-systems. A few species have a restricted distribution at the periphery of the area. *S. fragrans* has been collected in the higher forests of Bolivia, Peru, and Colombia at the western limit of the Amazon drainage. *S. grandiflora* has been collected principally near the coast from the mouth of the Amazon to the mouth of the Orinoco. *S. Garckeana*, *S. obtusifolia*, and *S. stipitata* have been infrequently collected, but these collections indicate a range from the Caribbean throughout the Amazon basin and southward to Rio de Janeiro. Species belonging to section *Paniculi* have been generally more frequently collected within the main Amazon basin. A few species such as *S. porphyrocarpa* seem to be restricted to the lower Amazon basin.

Of the two smaller groups mentioned, *S. brevispina*, *S. multiflora*, and *S. pubiflora* are restricted to Venezuela and Colombia in northwestern South America. *S. monosperma* and *S. lasiocoma* are found primarily in southeastern coastal Brazil as far south as Rio Grande do Sul.

Trends of Specialization

Within the New World *Sloaneae*, several lines of specialization have become apparent. These include (1) a trend toward modification of the inflorescence, (2) a trend toward reduction of the inflorescence (Plate 1), (3) a development of specialized capsular spines (Plate 2), and (4) the development of large, persistent stipules.

The basic pattern from which the trends of specialization seem to have developed is probably that pattern represented by the species of section *Paniculi*. In this group, the inflorescences are complex and many-flowered (Plate 1-A, D), the flowers are tightly closed buds before anthesis, the stamens are very numerous, and the stipules are present only as very small processes in the terminal bud before the leaf develops. Basically, the capsules of the group are unarmed, but a development of scattered stout prickles is found in *S. latifolia* (Plate 2-B), and is carried to its greatest development in the numerous stout spines of *S. durissima*. These

spines are apparently epidermal or subepidermal in origin, appearing after fertilization of the ovules as a part of capsular growth. That they are not modified hairs is shown by the simple trichomes on their surface which vary in no way from the trichomes on other plant parts. The anthers of the stamens are usually linear, the filaments are short and the awns are small.

The species of section *Paniculi* are concentrated in northern South America between the Amazon River and the Caribbean. *S. caribaea* is found northward in the Lesser Antilles. Several species of this section have been collected south of the Amazon, but only along major tributaries. This region of northern South America is probably the center of diversification of the genus, in the Americas and the concentration of species of this most conservative, and, apparently, most primitive section here is noteworthy. That the sandstone mountains of the region are geologically old is perhaps significant, although I have found no evidence of especially primitive characters in the species which have been collected from the slopes of these mountains.

The modification of the inflorescence from a paniculate, many-flowered form to a few-flowered racemose inflorescence (Plate 1-A, D-H) may be followed in the species of section *Corymbo-racemi*. Probably the intermediate type of inflorescence shown in *S. nitida* is a stage in the extreme reduction of the inflorescence shown by *S. jamaicensis* (Plate 1-B, C). The spines show little modification from those known in section *Paniculi*, nor are the stipules any more prominent in most of the species than in the latter section. The umbellate type of modification (Plate 1-F) shown in *S. Garckeana* is probably secondary to the reduction of the paniculate inflorescence, and the mixed inflorescences of *S laurifolia* (Plate 1-E) are more properly to be interpreted as a type tending toward the completely racemose inflorescences of subgenus *Sloanea*. The few-flowered inflorescences of *S. monosperma*, *S. Berteriana*, and *S. Fendleriana* are essentially racemose, and the flower-number is much reduced. Interestingly enough, the stipules of some of the species of this section are subpersistent. Although *S. laurifolia*, *S. Berteriana*, and *S. Fendleriana* bear unarmed capsules, or capsules with scattered stout prickles, the most highly specialized type of capsular spine is found in this section. *S. monosperma*, *S. porphyrocarpa*, *S. Garckeana* and *S. terniflora* (the latter three with highly modified inflorescences) all bear capsules with uniformly short, generally clavate, easily detached spines (Plate 2-G). On these spines, the trichomes are flattened, shining and sharp (Plate 3-F). When the individual

spine pierces the skin, it works further in with each movement of the tissue.

Along with the development of a racemose inflorescence, there has been a reduction in size of the sepals so that the essential organs of the flower are not covered in the bud. This condition sets subgenus *Sloanea* apart from subgenus *Quadrisepala*. In the former subgenus, the stipules become larger and tend to be peristent. The inflorescences are completely racemose (only the pedicels of the highly modified *S. zuliaensis* are cymosely arranged; Plate 1-G), and usually few-flowered. In section *Brevispicae*, the stamens have anthers reduced to a small area which may be surmounted by a long filiform awn as in *S. rufa* and *S. Duckei*. The number of stamens in each flower is generally less than in the flowers of species of section *Paniculi*. In section *Sloanea*, the stipules have often become very obvious parts of the plant. In the type-collection of *S. fragrans*, they are foliaceous, and in *S. medusula* the stipules are sub-foliaceous, the inflorescences of *S. zuliaensis* show a remarkable secondary modification in the truncate condition of the stamens, although the numerous, cymosely arranged flower-pedicels may be interpreted as a more primitive condition than the simple racemes of other species of the subgenus.

Economic Importance

The New World species of *Sloanea* are primarily rain-forest trees with a scattered distribution within the tract where they occur, as is characteristic of most woody species of the rain-forest. The Sloaneas have never become widely used either by native people or for export from the tropics. The wood of *Sloanea* is locally used in some areas. Thus, *S. guianensis* is used for paddles and fire-wood in eastern Peru; *S. brevispina* is known as a wood of good quality in Colombia; *S. Massoni* is used for construction timber in Guadeloupe; and *S. multiflora* is used both in Venezuela and Colombia. However, the label-data indicate that the wood is hard and dense (Kribs' (1928) report on the wood-anatomy may be based on wood from an adventitious shoot). Probably for technological reasons, this wood has never become well known in commerce. Also, the generally scattered distribution of the trees in a tropical forest makes logging an expensive and difficult undertaking, so that it has been economically feasible in the past to cut only those woods for which there is a ready sale while species of trees with wood of equal or better quality for specific purposes have been ignored.

A few of the species are known to bear fruit with an edible aril, used by birds, mammals and fish, according to label-data. These are also suitable for human consumption, but the aril makes up only a small part of the fruit and, therefore, can never become a very important food-source. Steyermark reports that the fruit of *S. laurifolia* is ground and cooked "like arepa de mais," but that the uncooked fruit induces a "loco" feeling.

Systematic Treatment

The generic description given here applies to the American species of *Sloanea*, and does not include the Old World species of *Sloanea*. Most of the Old World species differ in having petals and/or in having the seed only partially enveloped in the aril and/or in having more numerous seeds in each locule of the capsule. Section-descriptions and keys to the sections of the genus will be found at the beginning of each group of species.

Sloanea Linnaeus, Sp. Pl. 512. 1753.

Ablania Aubl., Pl. Guian. 585, tab. 234. 1775.
Trichocarpus Schreb., Gen. Pl. 366. 1789.
Blondea L. C. Rich., Act. Soc. Nat. Hist. Paris. **1**:110. 1792.
Lecostemon Moc. & Sessé ex DC., Prodr. **2**: 639. 1825.
Dasynema Schott in Spreng., Syst. Veg. **4**: Cur. Post. 408. 1827.
Adenobasium Presl, Symb. Bot. **1**: 39, tab. 27. 1832.
Lasiocarpus Oerst., Vidensk. Medd. naturhist. Foren. 1853. Oversigt 26 de Mai 1852. Nomen nudum.
Dasycarpus Oerst., Vidensk. Medd. naturhist. Foren. 1855. 27. 1857.

Trees (rarely shrubs). Trunk often buttressed. Leaves alternate or opposite; stipules present, at least in the bud; petioles various, often incrassate at one or both ends, terete or canaliculate; leaf-blades pinnately veined, margin entire to dentate (spinose-dentate in one species). Inflorescences axillary (rarely terminal), commonly racemose or paniculate, occasionally corymbose, corymbo-racemose, or umbellate, many-flowered, rarely 1-flowered. Flowers with calyx of 4 to 11 sepals, usually free, petals none (one species with two whorls of perianth-parts of 4 members each); stamens about 50 to more than 100, various, but always with the connective continued above the anther-sacs into a knob or awn; pistil 3–6-loculed, ovules 8–10 in two rows per locule, anatropous, hanging, placentation axial; style entire or parted at the apex into as many branches as there are locules in the ovary. Fruit a loculicidally dehiscent capsule; valves 3–6, rigid, often woody; capsule unarmed, or armed with spines which may be firmly attached and flexible or rigid, straight or curved, or spines easily detached and irritant. Seeds 1 or 2 per capsule (rarely 3) covered to the middle or almost completely covered by an aril growing from, and firmly attached to, the chalazal end (except one species without an aril), raphe often prominent, testa thin, endosperm abundant, embryo straight with thin, flat cotyledons. Throughout tropical America from Nayarit, Mexico, and the Greater Antilles to northern Bolivia and southeastern coastal Brazil in Rio Grande do Sul. Type: *S. dentata* L.

Key to Subgenera and Sections.

A. Calyx not covering essential organs in the bud. Sepals 4–11, unequal. Flowers in lateral racemes. Stipules present with the developing leaves . . . . . Subgenus *Sloanea*.

B. Stipules caducous. Racemes generally crowded. Capsules at most 3.5 cm. long, generally less than 2.5 cm. long, unarmed (one species) or armed with short or flexible spines, or with irritant spines (one species) Section 1. *Brevispicae*.

B. Stipules persistent, at least with the 3 or 4 most recently developed leaves. Racemes generally open. Capsules at least 2.5 cm. long or longer, generally more than 3 cm. long, armed with long or rigid spines Section 2. *Sloanea*.

A. Calyx covering the essential organs in the bud. Sepals 4 (rarely 5) equal. Flowers in lateral (rarely terminal) panicles, lateral corymbs, corymbo-racemes, racemes or umbels. Stipules falling from the bud before the leaf develops . . . . . Subgenus *Quadrisepala*.

C. Inflorescences lateral and sub-terminal (rarely terminal), paniculate. Sepals often fleshy, light in color. Capsules unarmed, or with scattered stout prickles or with rigid stout spines . . . . . Section 3. *Paniculi*.

C. Inflorescences lateral, corymbose, corymbo-racemose, racemose or umbellate. Sepals generally membranaceous, often dark in color. Capsules unarmed, or with rigid spines, or with short irritant spines (spines rarely flexible) . . . . . Section 4. *Corymbo-racemi*.

Subgenus Sloanea nom. nov.

Arbores (raro frutices). Stipulae cum foliis explicentes. Inflorescentia axillaris, racemosa. Sepala 4–11, inaequalia, stamina pistillumque praeanthesin non tegentia. Capsulae cum spinis aut brevibus et flexilibus vel rigidis aut longis et flexilibus vel rigidis (si flexilibus, plerumque fortiter falcatis) (una species sine spinis et una cum spinis irritantibus). Type: *S. dentata* L.

Section 1. Brevispicae nom. nov.

Brachystachyae Benth., Journ. Linn. Soc. **5:** suppl. 63. 1861, *pro parte*.

Arbores (raro frutices). Stipulae deinde caducae, plerumque parvae, deltoideae vel lanceolatae. Inflorescentia axillaris, racemosa, plerumque conferta. Sepala 4–11, inaequalia; plerumque antherae quam filamenta longiores. Capsulae ad 3.5 cm. longae, plerumque breviores, 2.5 cm. longae, cum spinis brevibus, flexilibus (in *S. granulosa*, plerumque inermes). Throughout the range of *Sloanea* in the New World; with section *Sloanea* making up the majority of species of Central America and the West Indies. Type: *S. Massoni* Sw.

Key to Section 1. Brevispicae.

A. Leaves spiny-margined.....15. *S. ilicifolia.*
A. Leaves entire, undulate, or dentate, but not spiny-margined.
B. Leaves clustered at the ends of the twigs.
C. Awn of stamens long, filiform; capsule to 2 cm. long; spines to 5 mm. long.....10. *S. rufa.*
C. Awn of stamens short, thick.
D. Capsules unarmed, granulose; sepals 4 or 5.....11. *S. granulosa.*
D. Capsules armed with numerous spines 8–10 mm. long; sepals 5–8.
E. Calyx of 5 sepals usually; connective narrow, light; capsular spines scattered-pubescent.....9. *S. spathulata.*
E. Calyx of 6–8 sepals usually; connective broad, dark; capsular spines puberulent.....22. *S. brevipes.*
B. Leaves not conspicuously clustered at the ends of the twigs, but evenly spaced along twigs.
F. Connective continued only into a knob or short awn.
G. Sepals rarely more than 4.
H. Filaments and anthers glabrous; capsule to 18 mm. long; spines numerous, semi-flexible, to 2.5 cm. long 7. *S. parviflora.*
H. Filaments and anthers velutinous; capsule to 2 cm. long; spines dense, subrigid, to 7 mm. long...8. *S. obtusifolia.*
G. Sepals 4–9, generally more than 4.
I. Sepals 4–6.
J. Stamens long-exserted; capsule to 7 mm. long; spines to 2 mm. long, hispidulous.....4. *S. trichosticha.*
J. Stamens only moderately exserted.
K. Filaments glabrous; anthers ovoid; capsules to 2 cm. long; spines to 1 cm. long, rigid, tapered.....2. *S. Picapica.*
K. Filaments densely pubescent; anthers deltoid; capsule to 2 cm. long; spines to 3 cm. long, flexible.....14. *S. curatellifolia.*
I. Sepals 5–9, rarely as few as 4.
L. Stamens long-exserted.
M. Stipules to 3.5 mm. long; stamens to 9 mm. long, glabrous; capsule to 3 cm. long; spines to 12 mm. long, flexible; restricted to the Lesser Antilles.....13. *S. Massoni.*
M. Stipules to 8 mm. long; stamens to 4 mm. long, puberulent to glabrate; capsule to 2.8 cm. long; spines to 1.8 cm. long, flexible; Central America and northern South America.....25. *S. Tuerckheimii.*
L. Stamens moderately exserted, or only slightly longer than the sepals.
N. Stamens little longer than the sepals; filaments glabrous; capsules to 15 mm. long; spines to 15 mm. long, semiflexible, pubescent.....6. *S. Eichleri.*
N. Stamens moderately exserted.
O. Filaments puberulent; capsule (immature) to 1.5 cm. long; spines to 1.8 cm. long, flexible, puberulent.....24. *S. guapilensis.*

O. Filaments glabrous; capsules to 1.4 cm. long, spines to 4.5 mm. long, flexible, sparsely hirsute . . . . . 1. *S. meianthera.*

F. Connective continued above the anther-sacs as an awn ¼ to ½ the length of the anthers, or the awn very long and filiform.

P. Awn longer than the anther, filiform; capsule to 1 cm. long, spines to 2 mm. long, subrigid, with scattered, nitid trichomes . . . . . 10A. *S. Duckei.*

P. Awn ¼ to ½ the length of the anther.

Q. Sepals generally less than 7; anthers deltoid-lanceolate to lanceolate-ellipsoidal.

R. Stamens not exserted from the calyx.

S. Ovary ellipsoidal, more or less angled; capsule to 2.3 cm. long; spines to 5 mm. long, dense, flexible, pubescent . . . . . 16. *S. sinemariensis.*

S. Ovary ovoid, ridged; capsule to 7 mm. long; spines to 10 mm. long, subrigid, pubescent . . 23. *S. stipitata.*

R. Stamens exserted from the calyx.

T. Ovary angled, ellipsoidal to obovoid; capsule to 1.2 cm. long; spines to 9 mm. long, pubescent 3. *S. guianensis.*

T. Ovary subglobose or ovoid.

U. Ovary subglobose; capsule (immature) densely covered with semi-flexible, hirsute spines . 5. *S. Brenesii.*

U. Ovary ovoid.

V. Stamens slightly exserted; filaments puberulent; capsule (immature) to 11 mm. long with flexible spines to 3 mm. long . 18. *S. gracilis.*

V. Stamens well exserted; filaments pubescent; capsule to 2 cm. long; spines to 9 mm. long, semiflexible . . . . . 17. *S. pubescens.*

Q. Sepals 7 or more; anthers elliptical or lanceolate.

W. Stamens slightly exserted from the calyx.

X. Filaments pubescent; ovary 4-angled; capsule (immature) to 12 mm. long; spines to 10 mm. long, rigid, puberulent . . . . . 20. *S. Froesii.*

X. Filaments puberulent; ovary ridged; capsule to 2.5 cm. long; spines to 2 cm. long, semiflexible, scantily pubescent . . . . . 21. *S. robusta.*

W. Stamens well exserted from the calyx.

Y. Filaments puberulent; capsule to 2.5 cm. long; spines to 5 mm. long, stout, rigid, pubescent . 19. *S. faginea.*

Y. Filaments pubescent; capsule to 3 cm. long; spines to 3 mm. long, clavate, hispid . . . 12. *S. brevispina.*

1. **Sloanea meianthera** Donn. Sm., Bot. Gaz. **37**: 208. 1904.

Tree to 100 feet (*fide* Steyermark) or shrub (*fide* Gentle). Bark of branchlets brown; twigs moderately robust, striate, glabrous to minutely pubescent. Leaves opposite, spaced along twigs, petioles 1–2 cm. long, slender, canaliculate above, incrassate at both ends, glabrate to glabrous; blade 6–17.5 cm.

long, 2.5–7 cm. wide, lanceolate to elliptic to elliptic-ovate, membranaceous to firmly chartaceous; midrib and secondary veins light in color, impressed, glabrous to scantily pubescent above, prominent, glabrate beneath, secondary veins generally 8, arcuate-ascending; base of blade cuneate-acute, apex acuminate, obtuse to subacute, margin entire to undulate. Inflorescences 1–5-flowered, 1.25–3 cm. long, peduncle, pedicels and bracts minutely pubescent; peduncles 0.5–1.75 cm. long, pedicels 0.5–1 cm. long, bracts to 1 mm. long, navicular, ovate, subacute. Flowers 3–5 mm. long, 3 mm. in diameter; sepals 4 or 5, 1.5–2 mm. long, 0.3–1 mm. wide, lanceolate to ovate, pubescent, entire to bidentate at the apex, subacute; stamens 2–5 mm. long, filaments 1.5–4.5 mm. long, glabrous, anthers 0.3–0.5 mm. long, ovate, glabrous, connective continued into a short knob above the anther-sacs; pistil 2–4 mm. long, ovary 1–1.5 mm. long, 0.5–1 mm. in diameter, ovoid, usually 4-loculed, densely tomentose, style 1.5–2.5 mm. long, straight or twisted, deeply 4-parted, basal ⅓ pubescent, glabrous above. Capsule 1–1.4 cm. long, 0.75–1 cm. in diameter, ellipsoidal, single-seeded, generally 4-valved, sepals and disc persistent at the base; valves 0.5–1 mm. thick, surface tomentose, covered with numerous tawny spines; spines to 4.5 mm. long, each inserted on small tubercle, easily detached, tapering to the apex, sparsely antrorse-hirsute. Seed 1 cm. long, 0.5 cm. in diameter, ovoid, covered entirely with an aril which is firmly attached to the chalazal ⅓ of the seed.

Sloanea meianthera Donn. Sm. is found occasionally as a tree of the montane rainforests of Central America. It also may persist in second growth or cut-over areas where it is a small tree or shrub. Although resembling *S. guianensis* of northern South America, *S. meianthera* is readily distinguished by the floral character of the knob of the anther (*S. guianensis* is decidedly awned). It is locally known in British Honduras as "cola de pavo macho" or "cola de pava embra."

Throughout Central America from British Honduras to Costa Rica in the forests of the highlands at elevations up to 1070 m. (see Map 1).

BRITISH HONDURAS: Stann Creek Valley: Blue Mountain Valley, *Gentle 3232* (fl. & fr.) Feb. 24, 1940 (A, MO, NY); Camp 36 B.H.-Guatemala, *Schipp 1245* (fr.) June 20, 1934 (A, F, GH, MO, NY. S). GUATEMALA: ALTA VERAPAZ: Cubilquitz, *von Tuerckheim 8191* (Type-collection) (fl.) Feb., 1902 (A, F, GH, NY, US); HUEHUETENANGO: Between Ixcan and Río Ixcan, sierra de los Cuchumatanes, *Steyermark 49290* (fr.) July 23, 1942 (F). HONDURAS: CORTÉS: Area east of Agua Azul, Lake Yojoa, *Allen 6166* (fr.) Apr. 13, 1951 (GH). COSTA RICA: SAN JOSE: vicinity of El General, *Skutch 2595* (fl.) Feb., 1936 (NY, S, US); CARTAGO: Valley of Río Reventazon near Pavones, *Holm* and *Iltis 206* (fr.) June 30, 1949 (NY).

2. **Sloanea Picapica** Standley, Field Mus. Pub. Bot. **22:** 89. 1940.
S. ptariana Steyerm., Fieldiana: Bot. **28:** 360. 1952.

Tree to 125 feet high (*fide* Allen). Branchlets with gray bark, twigs numerous, slender, striate, subcanescent. Leaves opposite or subopposite, borne toward the end of the twig; stipules minute; petioles 0.4–1.2 cm. long, canalicu-

late above, incrassate at both ends, glabrate, blade 3–12.5 cm. long, 2–4.5 cm. wide, elliptic-ovate to ovate, membranaceous to coriaceous, midrib and secondary veins impressed, midrib glabrate, prominent, glabrous below, secondary veins 6–7, arcuate-ascending, joining the next vein above before reaching the margin of the leaf; base of blade subacute to obtuse, apex acuminate to attenuate, obtuse, margin entire to slightly undulate. Inflorescence 1–5-flowered, 0.7–1.5 cm. long, peduncles, pedicels and bracts cinereously pubescent, peduncles to 1 cm. long, pedicels 1–4 mm. long, bracts minute, triangular, obtuse; flowers dull-yellow, 5–7 mm. long, 2–3 mm. in diameter, sepals 4–5, ca. 2 mm. long, to about 0.5 mm. wide, lanceolate, acute, glabrate; stamens 2–3 mm. long, filaments 1.5–2 mm. long, glabrous, anthers to 0.5 mm. long, ovoid, glabrous, connective prolonged into a short knob above the anther-sacs; pistil 5–7 mm. long, ovary 1.5–2 mm. long, 1.5–2 mm. in diameter, obovoid, 4-angled, 4-loculed, densely pubescent, styles 4, glabrous, acute, usually maroon-tipped. Capsule 1.5–2 cm. long, 1.2–1.5 cm. in diameter, ovoid, receptacle persistent at base as reflexed ring, generally 4-valved, valves 1–4 mm. thick, surface pubescent, covered with rigid spines; spines deep-red, glabrous, narrowed abruptly from the base, tapering to the acute apex. Capsule generally single-seeded, seed ovoid, covered with a three-lobed aril which is firmly attached to the chalazal end of the seed.

Sloanea Picapica Standl. is a distinctive species with its short-petioled leaves, short pedicels and capsule with short rigid spines. It probably represents the end-point of one line of variation of the *S. guianensis* complex.

The distribution of this species is unusual. Its occurrence in the interior highlands of Venezuela and British Guiana is at variance with the normal pattern, in that Central American species usually occur on the coastal areas of northern South America. However, there is no doubt that the Central American and South American specimens belong to the same species. There is less variation in the specimens seen of *S. Picapica* than is normally found in species of *Sloanea*. Steyermark, in describing *S. ptariana*, did not recognize that the collection is conspecific with *S. Picapica* of Central America.

Standley took the specific name of this species from the local Honduranean name for the tree "pica pica." In Venezuela this tree is called locally "waraumi-yek."

Known from Honduras to Costa Rica in Central America with an extension into the state of Bolívar in Venezuela (see Map 1).

HONDURAS: Colon, Wispernini Camp, *W.* and *C. von Hagen 1390* (Type-collection) (fr.) Mar., 1938 (F, NY). NICARAGUA: ZELAYA: Montaña Esquipulas, *Shank* and *Molina 4724* (fr.) Nov. 22, 1951 (GH). COSTA RICA: PUNTARENAS: Near Palmar Sur de Osa, *Allen 6024* (fr.) Mar. 24, 1951 (GH). VENEZUELA: BOLÍVAR: Ptari-tépui between Río Karaui and first ridge above Río Karaui, *Steyermark 60668* (Type-collection, *S. ptariana*) (fl.) Nov. 28, 1944 (A, F, NY, VEN).

2a. **Sloanea Picapica,** var. **hirsuta,** C. E. Smith var. nov.

Ramuli nigrescento-hirsuti. Petioli dense nigrescento-hirsuti; lamina coriacea, rugosa, nervus primarius supra basi ⅓ hirsutus, subtus sparse hirsutus. Valvae capsularum crassae; spinae sparse pubescentes.

Var. *hirsuta*, based on *A. C. Smith 2981* from British Guiana, differs from the other collections I have cited in the thicker, more rugose leaves, the somewhat thicker valves of the capsule, and, particularly, in the nigrescent-hirsute twigs and petioles and the pubescent capsular spines.

British Guiana: Akarai Mountains, height of land between drainage of Río Mapuera and Shodikar Creek, *A. C. Smith 2981* (fr.) Jan. 19, 1938 (A (Type), F, G, K, MO, NY, S, US).

3. **Sloanea guianensis** (Aubl.) Bentham, Journ. Linn. Soc. **5:** suppl. 69. 1861.

Ablania guianensis Aubl., Pl. Guian. 585, tab. 234. 1775.
Trichocarpus laurifolius Willd., Sp. Pl. **2:** 1224. 1800.
Dasynema pubescens Schott in Spreng., Syst. Veg. **4:** Cur. Post. 408. 1827.
Sloanea alnifolia Mart., Flora Beibl. **20:** 94. 1837.
S. alnifolia var. *lancea* Schum. in Mart., Flor. Bras. **12** (3): 194. 1886.
S. alnifolia var. *ovalis* Schum. in Mart., Flor. Bras. **12** (3): 194. 1886.
S. cuneifolia Mart. loc. cit.
Dasynema alnifolium (Mart.) Walpers, Repert. **1:** 352. 1842.
D. cuneifolium (Mart.) Walpers, loc. cit.
D. pubescens Turcz. (?) Bull. Soc. Imp. Nat. Moscow **31:** 224. 1858.
Sloanea microcarpa Pl. ex Benth., Journ. Linn. Soc. **5:** suppl. 69. 1861.
S. guianensis var. *microcarpa* (Pl. ex Benth.) Schum. in Mart., Flor. Bras. **12** (3): 191. 1886.
S. breviseta Steyerm., Fieldiana: Bot. **28:** 357. 1952.

Tree to 25 m. tall with triangular buttresses, or a shrub. Bark of branchlets grayish-brown to chocolate-brown, striate; twigs slender to robust, indistinctly striate, enlarging slightly upward to each node, glabrous to dark-fuscous-pubescent. Leaves opposite to subopposite, spaced along the ends of the twigs; stipules 0.5–1 mm. long, lanceolate, obtuse, generally pubescent; petioles 1–3 cm. long, terete, scarcely canaliculate above, more or less incrassate at both ends, glabrous to minutely fuscous-pubescent along the ventral side; blade 5–22 cm. long, 2.5–9.5 cm. wide, obovate, elliptic-obovate or elliptic-lanceolate, membranaceous to chartaceous, mid-rib scarcely impressed, glabrous to minutely pubescent above, midrib and secondary veins prominent, glabrous to pubescent to scantily hirsute beneath, secondary veins 7–10, arcuate-ascending, at times barbate in the axils, base of blade obtuse to cuneate-acute, apex of blade obtuse, at times mucronate, to acuminate-obtuse, occasionally attenute-obtuse, margin entire to undulate to sinuate, repand-dentate to strongly obtuse-dentate. Inflorescences 1–9-flowered, 1.5-3 cm. long, peduncles, pedicels and bracts sparingly to densely fuscous-pubescent, peduncles 0.3–1.5 cm. long, pedicels 3–8 mm. long, bracts 5–15 mm. long, deltoid to lanceolate-obtuse, margin entire to few-dentate; flowers white to

creamy-white to yellow, 3–8 mm. in diameter, 5–8 mm. long; sepals 4–9. variable in size and shape, 1–3 mm. long, 0.5–2 mm. wide at the base, lanceolate to deltoid to ovate, obtuse to acute, entire to occasionally bidentate, sparingly and minutely puberulent to pubescent without, sparingly pubescent to glabrous within; stamens 2–4 mm. long, filaments 1.5–3 mm. long, sparingly hirsute to densely pubescent, anthers 0.5–1 mm. long, lanceolate-elliptic to lanceolate-ovate, often narrow when seen from the ab- or adaxial side, connective often wide, dark in color and glabrate, prolonged into an awn ¼ to ⅓ as long as the anther; pistil 3–6.5 mm. long, ovary 1.5–2 mm. long, elliptic to obovoid, round to 4-angled, densely pubescent, generally 4-loculed, style 4-parted near the apex, or almost to the ovary, straight or contorted, pubescent at the base, glabrous above. Capsule 0.9–1.2 cm. long, 6–9 mm. in diameter, generally 4-valved; valves 0.75–1 mm. thick, surface velutinous, moderately beset with spines 5–9 mm. long; spines sparsely antrorse-pubescent. Seed to 1 cm. long, 0.6 cm. in diameter, covered almost entirely by a 5-lobed aril which is firmly attached to the chalazal ⅕ to ⅓ of the seed.

Sloanea guianensis (Aubl.) Benth. has been one of the most confused of the species-complexes in the genus. It has been collected from widely separated areas in South America and has, accordingly, received several different names. In this species, there is a wide variation in general aspect due to the foliar variation. Again, the spines of the capsule tend to vary in length in plants from different parts of the range. An examination of the flowers shows a smaller range of variation in the sepals. At times the anther-shape and -pubescence approach closely those of *S. pubescens* and *S. gracilis*. However, when all of the material is compared on all characters, there can be no doubt that all of the specimens cited belong to the same species.

The foliage of the Guiana material of *S. guianensis* which I have seen is more or less elliptical in outline. It is probably this form which Aublet described as *Ablania guianensis* in 1775. Subsequently, wider-leaved collections from eastern Brazil were named *Dasynema pubescens* Schott (1827), *Sloanea alnifolia* and *S. cuneifolia* Mart. (1837). The latter two entities were transferred to *Dasynema* (a generic segregate primarily based on an unstable pistil-character) in 1842. As late as 1858, Turczaninow published *Dasynema pubescens* as a new species based on "Blanchet 3356." As I have found no such *Sloanea* collection in the major herbaria, I assume that the collection is actually *Blanchet 2356*, and I have now transferred Turczaninow's species to the synonymy of *S. guianensis* with a query. *S. microcarpa* Pl. ex Benth. is clearly another synonym of *S. guianensis*. The most recently published species in the complex is *S. breviseta* Steyerm. which fits well within the range of foliar variation of the species. The short spine-character by which Steyermark separates this

entity from *S. guianensis* is based on fruit from which many of the spines have fallen. As the length of the remaining spines reaches the lower limits of variation in the rest of the collections which I have seen, I cannot accept this as a valid difference.

The species is common in occurrence and well known locally as shown by the many common names applied to the tree. In Dutch Guiana it is called "koesoeweran." In Pará, Brazil, it is known as "urucu rana" as are many other species of *Sloanea*; in Matto Grosso, Brazil, it is called "pente de macaco" and in Santa Catherina it is "laranjeira do mato." In Peru, where *S. guianensis* is known as "cutana-caspi," the local people value the tree for firewood and paddles (*fide* Mexia).

S. guianensis appears to be a tree primarily of the higher land in the major river-basins of South America. Differences in foliage seem to be correlated to some extent with the geographic distribution of the species, the more or less entire-margined, acuminate foliage of the type-description being found primarily in the Guiana region. Leaves of specimens from eastern South America tend to be somewhat broader, while the leaves of the specimens from the Bolivian area are usually more deeply dentate. There are undoubtedly environmental differences in the foliage also, but because of insufficient label-data, no definite conclusions can be drawn.

S. guianensis (Aubl.) Benth. has been collected from Trinidad and the northern coast of South America as far west as Venezuela, then south throughout Brazil as far as the state of Rio de Janeiro (see Map 1).

TRINIDAD: Botanic Garden Herb. 2815 (fr.) (US). FRENCH GUIANA: Environs de St. Laurent, près de Maroni, *Santini s. n.* (fr.) Sept., 1910 (L); *Perrottet s. n.* (fr.) 1820 (F). DUTCH GUIANA: Brownsberg: arbor 1045, Herb. Acad. Rhenotraiect. 4007 (fl.) Sept. 14, 1918 (L, US); Kaboerie, arbor 662, Herb. Acad. Rhenotraiect. 5980 (fl.) Aug. 14, 1922 (L, NY). BRITISH GUIANA: Keriti Creek, lower Essequibo River, Forest Dept. field F-968, record 3704 (fl.) Oct. 12, 1942 (K); Irmamaipang, Kanaku Mts., Forest Dept. field WB-551, record 5950 (fl.) Nov., 1948 (NY). VENEZUELA: MONAGAS: Montaña de Aguacate, along Quebrada de Pajarral, *Steyermark 62215* (Type-collection, *S. breviseta*) (fr.) Apr. 19, 1945 (F, NY, VEN). BRAZIL: PARÁ: Rio Guamá, São Miguel, FRÓES *20426* (fr.) Jan. 14, 1945 (BI, NY, VEN); Belém: Bosque Municipal, *Pires* and *Black 1428* (fr.) Apr. 5, 1947 (GH); loco Entroncaménto, *Ducke*, Herb. Jard. Bot. Rio de Janeiro 20974 (fl.) Aug. 10, 1926 (US); Silvis ad flum. Amazona, *Martius s. n.* (Type-collection, *S. cuneifolia*) (photo.) (fr.) Sept. (F, GH); AMAZONAS: Municipality Humayata near Livramento on Rio Livramento, *Krukoff 6931* (fr. immature) Oct. 13-Nov. 6, 1934 (A, BI, F, K, MO, NY, S, US); Santa Maria, Paraná do Arauato, *Fróes 25143* (fl.) Aug. 10, 1949 (BI); Tonantins, loco Villa Nova, *Ducke 1834* (fr.) Dec. 14, 1945 (A, BI, F, NY,

RB, US); Rio Juruá, Juruá Miry, *E. Ule 5902* (fl.) Sept., 1901 (G, K, L); TERRITORY OF ACRE: Near mouth of Rio Macauhan (tributary of Rio Yaco): *Krukoff 55418* (fl.) Aug. 11, 1933 (A, F, NY, S, US); MARANHÃO: Maracassumé River region, *Fróes 1785* (fr.) July 14, 1932 (A, F, G, MO, NY, S, US); BAHÍA: Ilheos, *Moricand 2356* (This is probably *Blanchet 2356* which it matches in detail) (fl.) (K); Ilheos, *Blanchet 2356* (fl.) (F, G, P); MATTO GROSSO: Near Tabajara, upper Machado River region, *Krukoff 1396* (fr.) Nov., Dec., 1931 (A, F, MO, NY, S, US); RIO DE JANEIRO: Corcovado, *Guillemin 663* (fr.) 1839 (F); Rio de Janeiro: *Riedel 887* (Type-collection, *S. alnifolia* var. *lancea*) (fl.) Sept., 1832 (F, GH, (photo.), S); Serra d'Estrella, bois de Botequim, *Glaziou 7817* (fr.) Nov. 15, 1874 (A); Petropolis, Itamarahy, *Glaziou* 6481 (fl.) Sept. 9, 1873 (K, NY); Estrada do Lumaré, *Ducke* and *Kuhlmann*, Herb. Jard. Bot. Rio de Janeiro 41487 (fl.) Oct. 31, 1939 (RB); Parque Nacional do Itatiaya, *W. Duarte Barros 35*, Herb. Jard. Bot. Rio de Janeiro 45668 (fl.) Sept. 26, 1940 (RB); MINAS GERAES: *Claussen 2057* (fl.) Aug.–Apr. 1840 (L, US); Itba, Fundes, *A. Macedo 1127* (fl. & fr.) July 4, 1948 (MO); SÃO PAULO: Santos, *Mosén 2785* (Type-collection, *S. alnifolia* var. *ovalis*?) (fr.) 1874 (S, US); PARANÁ: Morretes, Porto da Cima, *G. Hatschbach 1929* (fl.) Aug. 20, 1950 (S, US); STA. CATHERINA: Brusque: *P. R. Rietz 3912* (fl.) Oct. 20, 1949 (US); Mata da Azambuja, *R. Klein* 5 (fl. & fr.) Jan. 19, 1950 (US). BOLIVIA: Junction of Ríos Beni and Madre de Dios, *Rusby 1294* (fl. past anthesis) Aug. 1886 (GH, NY, P, US); Rurrenbaque: *Rusby 1583* (fl. past anthesis & fr.) Oct. 8, 1921 (GH, NY, PH, US); Guanai, *Rusby 2649* (fr.) May 1886 (F); STA. CRUZ, Buena Vista, *Steinbach 1561* (fr.) Aug., 1925 (GH). PERU: LORETO, above Pongo de Manseriche, Río Marañon, *Mexia 6137* (fl. past anthesis & fr.) Nov. 21, 1931 (F, GH, K, MO, NY, S); Stromgebiet des Ucayali, *G. Tessman 3213* (fl.) 1923 (G, NY, S).

4. **Sloanea trichosticha** Williams and Sandwith in Flora of Trinidad and Tobago, **1**: 110. 1929.

Tree to 90 feet, buttressed (*fide* Maguire and Fanshawe). Bark of branchlets dark-gray to brown, obscurely striate; twigs robust, scarcely striate, glabrous to minutely pubescent; lenticels elongate, light in color. Leaves opposite to sub-opposite, lanceolate-elliptic to elliptic to elliptic-ovate, membranaceous; stipules caducous, lanceolate, obtuse, densely pubescent; petioles 0.5–2.75 cm. long, terete to subcanaliculate, slender, glabrous to minutely pubescent, often densely tomentose on a line on upper side; blade 6–16.5 cm. long, 2.5–6.5 cm. wide, midrib and secondary veins prominent to impressed, often puberulent above, prominent, glabrous to puberulent, occasionally sparsely long-hirsute beneath, secondary veins 5-7, arcuate-ascending, tending to join before the margin, light in color, tertiary veins prominently joining the midrib at right angles, reticulation coarse, irregular, often obscure; base cuneate-subacute to obtuse; apex acuminate, obtuse, margin entire to scarcely irregularly undulate. Inflorescences 1–2.5 cm. long, peduncles, pedicels and bracts puberulent; peduncles 0.7–1.5 cm. long, slender; pedicels 3–8 mm. long; bracts deltoid-obtuse, naviculate, puberulent to pubescent; flowers 3–4 mm. long, 2–3 mm. in diameter, sepals 4–5, irregular in shape and size, 0.5–1.5 mm. long, 0.5–1.0 mm. wide at the base, deltoid to lanceolate, subacute to obtuse, puberulent to pubescent; stamens 2–3 mm. long, long-exserted, filaments 1.5–2.5 mm. long, glabrous to puberulent, anthers 0.2–0.5 mm. long, ovate, glabrous to very minutely puberulent, connective prolonged only into small knob; pistil 1.5–3 mm. long, ovary 0.75–1.5 mm. long, 0.5–1.0 mm. in diameter,

ovoid, densely pubescent, styles 1–1.5 mm. long, 4-parted at the apex, often deeply so. Capsule ellipsoidal, 6–7 mm. long, 3–4 mm. in diameter (perhaps immature), sepals and receptacle often persistent at the base, style persistent at the apex, 4-valved; valves to 0.5 mm. thick, surface pubescent, densely covered with hispidulous brown untapered spines to 2 mm. long. Seed not adequately preserved for description.

Sloanea trichosticha is closely related to the *S. guianensis* complex, being distinguished primarily by its smaller flowers, awnless stamens, and spines of the fruit which are fairly densely hirtellous. In Trinidad it is locally known as "bois noir" and in British Guiana as "maharacaballi."

The range of this species extends from Trinidad and British Guiana southward into the upper Amazon drainage in Brazil. (See Map 1.)

TRINIDAD: Botanic Garden Herb. 646 (Type-collection) (fr.) (K, US); Arena: *R. L. Brooks 12472* (fr.) Mar. 6, 1931 (K). BRITISH GUIANA: Upper Demerara River, *Jenman 4328* (fl.) Dec. 1887 (K); Kamuni Creek, Groete Creek, Essequibo River, *Maguire* and *Fanshawe 22931* (fl. past anthesis) Apr. 21, 1944 (K). BRAZIL: AMAZONAS: Rio Acre, *E. Ule 9635* (fl.) July 1911 (K, L); Municipio de Humaitá, proc. a Livramento, *Krukoff 6919* (fl.) Oct.–Nov., 1934 (BI, RB).

5. **Sloanea Brenesii** Standley, Field. Mus. Publ. Bot. **18:** 661. 1937.

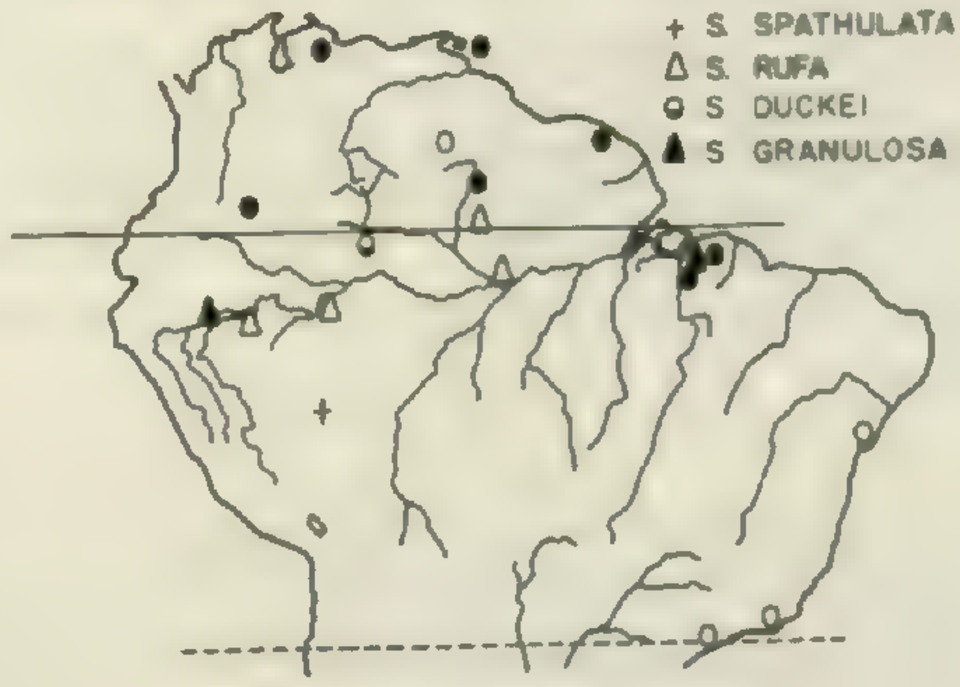
Tree (?). Branchlets with gray, obscurely striate bark; twigs robust, sulcate, pubescent, becoming glabrate. Leaves opposite to subopposite, crowded toward the ends of the twigs, elliptic to obovate, subcoriaceous; stipules lanceolate, hirsute; petioles 0.5–1.3 cm. long, puberulent, becoming glabrate, with a line of dense pubescence along the canaliculate upper side, scarcely incrassate at the base; blade 4.5–9 cm. long, 2.5–4.0 cm. wide, midrib and secondary veins impressed, pubescent above, prominent, sparsely pubescent beneath, secondary veins 6–8, arcuate-ascending, tertiary veins rough, sparsely puberulent, joining the midrib prominently at right angles, reticulation irregular, coarse, somewhat obscure; base of blade subacute to obtuse, apex subacute to acute, margin undulate becoming repand-dentate toward the apex. Inflorescences 1–2.5 cm. long, pedicels 0.2–0.8 cm. long, bracts soon deciduous, naviculate, deltoid, obtuse, 0.5–1 mm. long. Flowers 3–4 mm. long, ca. 5 mm. in diameter, stamens barely exserted beyond the calyx; sepals usually 4, sparsely puberulent without, more densely puberulent toward the margins within, 2–3 mm. long, 1.5–2 mm. broad at the base, ovate, entire, obtuse; stamens 2–4 mm. long, anthers about 1 mm. long, lanceolate-ovate, puberulent, anther-sacs inflated, rounded at the base, dehiscing ⅓–⅔ of their lengths by an apical linear pore, connective prolonged into a very short awn; filaments robust, filiform, scattered-erect-long-pubescent; pistil to 4 mm. long, ovary to 2 mm. long, subglobose, 4–5-loculed, densely pubescent; style to 2 mm. long, arising abruptly from the ovary, thick, puberulent on the basal ½–⅔, apex 4–5-parted. Capsule (immature) subglobose, 4–5-valved, single-seeded, receptacle persistent at the base; valves ca. 1.5 mm. thick, densely covered with semiflexible moderately antrorsely hirsute spines. Seeds too immature to be used.

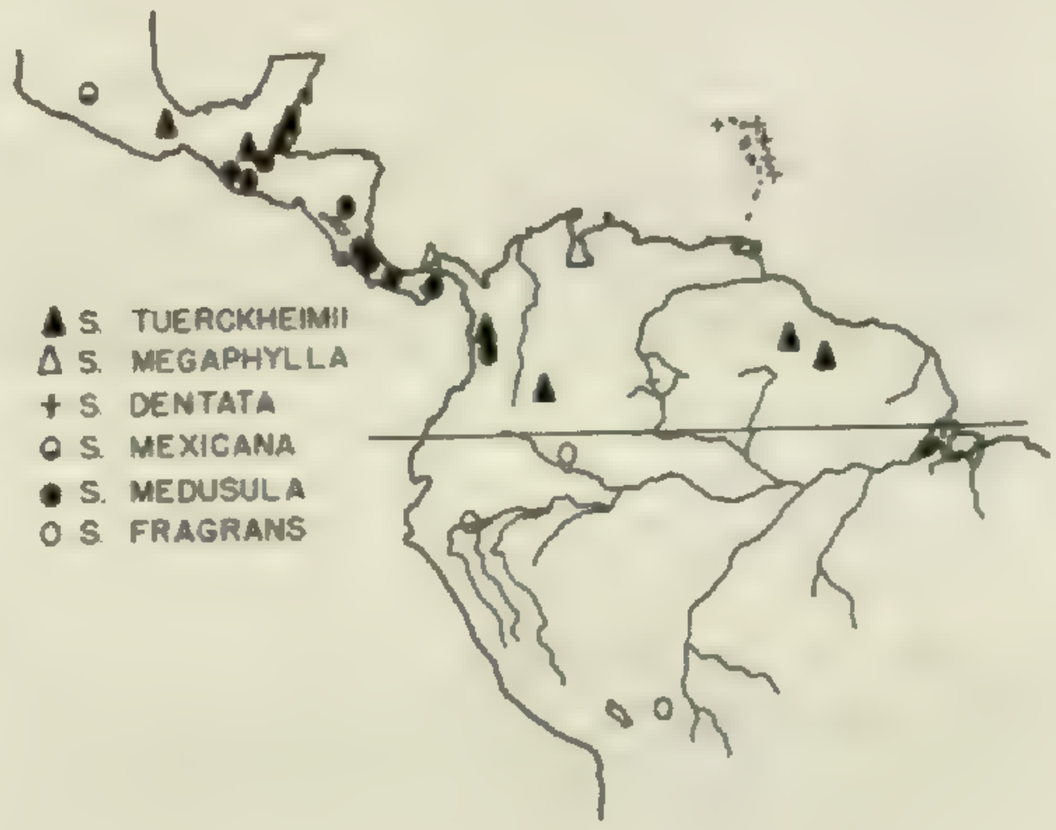
Sloanea Brenesii Standl. is an infrequently collected species endemic to Costa Rica (see Map 1). Because of the paucity of material, I cannot place this entity exactly, but it seems to be most closely related to the *S. guianensis* group of the section *Brevispicae*. The broad sepals suggest close affinities with section *Corymbo-racemi*, but there is no evidence on the specimens which I have seen that the sepals are closed over the reproductive parts before anthesis. It may be necessary to transfer the species to the latter section if the evidence from future collections proves its affinities.

Costa Rica: La Palma de San Ramón, *A. M. Brenes 6334* (Type-collection) (fr.) Sept. 21, 1928 (F); Entre San Ramón y La Palma de San Ramón, *Brenes 6178* (fl.) June 30, 1928 (F, US).

6. **Sloanea Eichleri** K. Schumann in Mart., Flor. Bras. **12** (3): 183, pl. 38, fig. 1. 1886.
Sloanea obidensis Ducke, Archiv. Instit. Biol. Veg. Rio de Janeiro **2**: 160. 1935.

Tree to 16 m. in height (*fide* Fróes and Pires); crown spreading with twisted branches (*fide* Williams). Bark of branchlets gray to brown, obscurely striate; twigs robust, sulcate, glabrous to ferrugineous-pubescent. Leaves alternate to subopposite, elliptic-ovate to ovate to elliptic-obovate, more numerous toward the ends of the twigs; stipules linear-lanceolate, to 3 mm. long, ferrugineous-pubescent; petioles 1–4.5 cm. long, glabrate to ferrugineous-pubescent, canaliculate above, more or less incrassate at the apex; blade 5.5–23 cm. long, 3.5–12 cm. wide, midrib and secondary veins somewhat impressed-pubescent above, prominent, glabrous to densely pubescent beneath, secondary veins ascending, generally arcuate only near the margin, base obtuse to cuneate-acute, apex retuse to obtuse to cuspidate to acuminate-obtuse, margin entire to undulate to obscurely repand-dentate. Inflorescences 1.5–5.5 cm. long, 5- to many-flowered; peduncles 0.5–3.5 cm. long, pedicels 3–12 mm. long, bracts 1–2 mm. long, deltoid to linear-lanceolate, obtuse; flowers yellowish-white to yellow, 7–9 mm. long, 2–5 mm. in diameter, sepals 5–9, variable in size and shape, 2–3 mm. long, 0.5–1.5 mm. wide at the base, deltoid to lanceolate, obtuse to subacute, puberulent to sparsely pubescent; stamens 3–4 mm. long, anthers 0.5–1 mm. long, ovoid, glabrous to scarcely puberulent, anther-sacs dehiscing from ⅓ to their entire length, the connective on the abaxial side often equalling or exceeding the width of the anther-sacs on either side, extended slightly above the anther as a knob; filament 2–3.5 mm. long, filiform, glabrous; pistil 5–7 mm. long, ovary 2–2.5 mm. long, 1.5–2 mm. in diameter, ovoid, narrowing to the style, densely puberulent to pubescent, more or less terete to 4-angled, generally 4-loculed; style 2.5–5 mm. long, straight or twisted, puberulent on the basal ⅓–½, apex 4-parted. Capsule 12–15 mm. long, 9–11 mm. in diameter, ellipsoidal, style often persistent at the apex, 4-valved, 1-seeded; valves 1–1.5 mm. thick, minutely velutinous on the surface, densely covered with semi-flexible, pale-purple (*fide* Williams) spines; spines 11–15 mm. long sparsely antrorsely pubescent, slightly tapered, borne on a small tubercle, easily detached. Seed ellipsoidal, covered by a 3–5-lobed aril which is attached to the chalazal ⅓; lobes of the aril irregularly serrate.





MAPS 1–6. Map 1. (upper left), Map. 2. (upper right), Map 3. (center left), Map 4. (center right), Map 5. (lower left), Map 6. (lower right).

On Map 2 for *S. obtusa*, read *S. parviflora*.

Sloanea Eichleri Schum. has often been confused with *S. sinemariensis* Aubl. Although there is a general similarity in the foliage, the floral characters do not agree with Aublet's description (there are generally more than 5 sepals) and the fruit does not compare with that pictured in the Aublet plate. Although pubescence is often a poor character in *Sloanea*, specimens of *S. Eichleri* may often be tentatively identified by the overall pubes-

cence on the backs of the leaves. *S. sinemariensis* lacks this indument. All of the specimens I cite here agree with *Weddell 2478* from Brazil which Schumann cited with the original description of this species.

S. Eichleri has been collected from the Guianas and Venezuela southward through the Amazon basin and eastward as far as Bahía, Brazil (see Map 1).

French Guiana: Maroni (River), *Mélinon s. n.* (fl.) 1863 (GH); *Mélinon s. n.* (fl. & fr.) 1864 (F, GH, NY, US). Dutch Guiana: Boven-Suriname River, Wilhelminagebergte, Herb. Acad. Rhenotraiect. 45 (fr.) Jan. 1926 (NY); Sectie O, arbor 535, Herb. Acad. Rhenotraiect. 3945, Aug. 13, 1918 (US). Venezuela: Terr. Amazonas: En selva tupida y alta en la isla de El Ratón, *Llewelyn Williams 13211* (fr.) May 31, 1940 (A, F, US, VEN). Brazil: Pará: Obidos, *Ducke*, Herb. Jard. Bot. Rio de Janeiro 12369 (Type-collection, *S. obidensis*) (fl.) Nov. 11, 1919 (US); Belém: flôresta do Utinga, *Pires 1433* (fr.) Dec. 17, 1948 (GH); I. A. N., *Fróes 20781* (fr.) Dec. 6, 1944 (BI, K, NY); Beira do Rio Jamundá, San Jorge, Faro, *Black* and *Ledoux 50-10752* Nov. 12, 1950 (GH); Amazonas: Lago de Badajós, margem do Rio Capitarí *Froes 26435* (fl.) Aug. 29, 1950 (BI); Befé, *Black 47-1193* (fr.) Aug. 16, 1947 (GH); Bahía: Igreja Velha, *Blanchet 3340* (fl.) 1841 (F, G, NY).

7. **Sloanea parviflora** Planchon ex Bentham, Journ. Linn. Soc. **5:** suppl. 68. 1861.

   Dasynema obtusum Splitgerber in Hoev. and Vriese, Tijdschrift voor natuurk. Geschiedenis **9:** 98. 1842.

   Sloanea obtusa (Splitg.) Schumann in Mart., Fl. Bras. **12** (3): 181. 1886.

   Sloanea Kappleriana Pulle, Enum. Vasc. Pl. Surinam. 279, pl. 12. 1906.

Tree to 30 feet. Bark of branchlets gray-brown to brown, more or less striate; twigs slender to robust, at times angled, glabrate, puberulent or pubescent. Leaves generally alternate, clustered toward ends of twigs; stipules lanceolate, long-pubescent; petioles 0.5 2.5 cm. long, glabrate to puberulent with a line of dense pubescence along the canaliculate upper side, more or less incrassate at the apex; blade 6.5–42 cm. long, 3.5–21.5 cm. wide, elliptical to elliptic-ovate to ovate, chartaceous to coriaceous; midrib and secondary veins scarcely impressed, short-pubescent above, prominent, sparsely puberulent to pubescent beneath, secondary veins 8–11, arcuate-ascending, distinct from one another at the margin, base subacute to abruptly obtuse, apex obtuse, margin subentire to undulate to repand-dentate, the dentations becoming more prominent toward the apex of the leaf. Inflorescences 0.5–1 cm. long, flowers in dense clusters, peduncle, pedicels and bracts densely puberulent or pubescent; peduncles 1–3 mm. long, pedicels 0.5–1.5 mm. long, bracts to 0.75 mm. long, ovate, navicular, obtuse; flowers 3–4 mm. long, 2–3 mm. in diameter, sepals generally 4, 0.5–1.25 mm. long, 0.5–1 mm. wide at the base, ovate-deltoid to sublanceolate, obtuse; stamens 3–3.5 mm. long, filament 2.25–3 mm. long, glabrous, anthers 0.5–0.75 mm. long, ellipsoid-ovate, glabrous, connective terminating in a small knob above the anther-sacs; pistil 2–3

mm. long, ovary 1–1.5 mm. long, densely short-pubescent, 4-angled or 4-ribbed, style 0.5–2 mm. long, at times pubescent on the basal ¾, glabrous above, straight or twisted, apex deeply 4-parted, the style apparently much elongated after anthesis. Capsule 14–18 mm. long, 10–12 mm. in diameter, valves generally 4, capsule opening almost flat; valves 1–1.5 mm. thick, surface densely puberulent, covered with numerous semi-flexible red spines; spines 1.5–2.5 cm. long, covered with numerous antrorse-spiculate hairs. Seed ellipsoidal to ovoid-ellipsoidal, with a prominent raphe on one side; chalazal ⅕ especially thick; aril absent.

Sloanea parviflora Pl. ex Benth. is readily distinguished from the closely related species *S. Eichleri* by the very short inflorescence, the longer-spined fruit, and by the lack of an aril on the seed. The lack of an aril was found to be consistent in mature material from widely separated areas.

As in other early described species of *Sloanea*, *S. parviflora* has been re-described under another name. *S. Kappleriana* is conspecific with *S. parviflora*. Although the species was originally described as *Dasynema obtusum* Splitg. and properly transferred to *Sloanea* by Schumann, Bentham had previously renamed the species *S. parviflora* apparently because *S. obtusa* had been used in the herbarium for another species by Planchon.

Originally described from Dutch Guiana, *S. parviflora* is now known to occur in Trinidad, British and French Guiana, Colombia and Brazil (see Map 2 as *S. obtusa*).

Trinidad: Jackson Trace, Chat Lane, *W. E. Broadway 8474* (fr.) Nov. 29, 1916 (NY). French Guiana: Karouany, *Sagot 1146* (fr.) June 22, 1861 (F (photo. and fragment), GH, S). Dutch Guiana: Watramiri Herb. Acad. Rhenotraiect. 2491, tree 1622 (fl.) Dec. 7, 1916 (L, NY); *Kappler s. n.* (Type-collection, *S. Kappleriana*) (L); In sylvis prope Port Belair, *F. L. Splitgerber 8121* (Type-collection, *Dasynema obtusum* and *S. parviflora*) (fr.) Apr. 1838 (L). British Guiana: Mabaruma-Aruka River, N. W. D., Forest Dept. field 2361, record 5097 (fr.) Mar. 6, 1945 (K). Colombia: Florencia-Caquetá, orillas del Río Hacha, *C. Uribe Piedrahita s. n.* (fr.) Dec., 1930 (COL). Brazil: Pará: Belém: *Fróes 20780* (fl. & fr.) Dec. 6, 1944 (BI, K, NY); Amazonas: Bôa Vista, Rio Branco super, *J. G. Kuhlmann*, Herb. Jard. Bot Rio de Janeiro 3678 (fr.) July, 1913 (US); Maranhão: Serra de Pirocaua, Herb. Amaz. Mus. Pará 10370, Herb. Jard. Bot. Rio de Janeiro 20953 (fr.) Apr. 20, 1909 (US); Pernambuco: Recife, Brejo de Macacos, *Ducke 2306* (fr.) Jan. 25, 1952 (BI).

8. **Sloanea obtusifolia** (Moric.) Schumann in Mart., Fl. Bras. **12** (3): 181. 1886.

Adenobasium obtusifolium Moric., Pl. Amer. 83, tab. 55. 1840.

Dasynema obtusum (Moric. ?) Walpers, Ann. Bot. Syst. **1:** 110. 1848–49, not *D. obtusum* Splitgerber.

Sloanea obtusa Pl. ex Benth., Journ. Linn. Soc. **5:** suppl. 68. 1861.

S. Fernando-Costae Hoehne, Arquiv. Bot. Estad. São Paulo n. s. form maior **1:** 93, tab. 96. 1942.

Large tree with enormous buttresses (*fide* Occhioni). Branchlets brown, obscurely striate; twigs robust, striate, glabrate to puberulent. Leaves clustered toward end of twigs; stipules lanceolate, pubescent; petioles 3–7 mm. long, thick, more or less striate, canaliculate above, glabrate to puberulent; blade 3.5–5.8 cm. long, 2.5–4 cm. wide, midrib and secondary veins impressed, glabrous to puberulent above, prominent, glabrous beneath, base subacute to abruptly obtuse, apex obtuse to shallowly retuse, margin entire to scarcely undulate, tending to be revolute. Inflorescences 1–1.3 cm. long, peduncles, pedicels and bracts minutely puberulent, peduncles 2–4 mm. long, pedicels 3–7 mm. long, bracts 0.5–1 mm. long, deltoid, obtuse; flowers pale-yellow (*fide* Handro), 3–4 mm. long, 4–5 mm. in diameter, sepals generally 4, connate, 1.5–2 mm. long, broadly deltoid, obtuse, sparsely puberulent; stamens 1.5–3 mm. long, filaments 0.75–2 mm. long, robust, filiform, velutinous, anthers 0.75–1 mm. long, ovoid, velutinous-pubescent, connective broad on the abaxial side, prolonged into a knob above the anther-sacs; pistil 1.5–2 mm. long, ovary 1–1.5 mm. long, ovoid-globose, subquadrangulate, 4-loculed, densely covered with short pubescence, style 0.5–1 mm. long, glabrous, parted almost to the ovary from which it abruptly arises. Capsule (mature?) 1.7–2 cm. long, ellipsoidal, 4-valved; valves 4–4.5 mm. thick, surface rough, puberulent, densely covered with subrigid spines; spines to 7 mm. long, tapered from the base, covered with tiny antrorse trichomes. Seed not seen.

Sloanea obtusifolia (Moric.) Schum. has not been extensively collected but the specimens seen are distinct from other members of this group, particularly in the united sepals and very short style. In foliage it resembles some forms of *S. guianensis*.

In spite of its distinctness, *S. obtusifolia* has been redescribed recently as *S. Fernando-Costae*. Soon after the publication of *Adenobasium obtusifolium* by Moricand, Walpers transferred the species to *Dasynema*, citing the page and plate reference of the earlier publication. Walpers' name, however, appeared as *D. obtusum* (which must not be confused with *D. obtusum* of Splitgerber). Later, Bentham published the name *S. obtusa* Pl. based on the same collection. This was illegitimate inasmuch as an earlier name had already been published for the species, and Schumann correctly made the combination *S. obtusifolia* (Moric.) Schum.

S. obtusifolia has been collected primarily southeastward in Brazil with a recent extension of range into Venezuela (see Map 2).

VENEZUELA: El Papelón, cerros del Avila, *Delgado 321* (fr.) Jan. 8, 1942 (VEN); Cerca del Hotel de Rancho Grande, camino de la Cama, *Pittier 15732* (fr.) Mar. 18, 1948 (VEN). BRAZIL: BAHÍA: *Blanchet 1659* (Type-collection, *Adenobasium obtusifolium* and *S. obtusum* Pl. ex Benth.) (fl.) (F); RIO DE JANEIRO: Distrito Federal, matas do "Pai Ricardo," *Occhioni 163* Herb. Jard. Bot. Rio de Janeiro 52863 (fr.) Jan. 8, 1945 (RB); SÃO PAULO: Jardim Botânico, planta viva 324, *O. Handro 30844* (Type-collection, *S. Fernando-Costae*) (fl.) Aug. 21, 1933 (GH, RB).

9. **Sloanea spathulata** C. E. Smith spec. nov.

Arbor ad 18 m. alta. Cortex ramulorum cano-fulvus vel fulvus, perspicue striatus; surculi robusti, parce pilosi vel glabrati. Folia ad terminum surculorum congesta; stipulae ad 5 mm. longae, ad 0.5 mm. latae, lanceolatae, pilosae; petioli 3–9 mm. longi, robusti, pubescentes vel glabrati, supra canaliculati; lamina 12–33.5 cm. longa, 4.5–13.8 cm. lata, obovata vel anguste obovata, chartacea; nervus primarius et nervi secundarii supra impressi, subtus fortiter prominentes, parce pilosi; nervi secundarii arcuato-ascendentes, nervi tertiarii inaequales; basi abrupte obtusa, apice subacuta, mucronata; undulata, apice saepe repando-dentata. Inflorescentia immatura ad 10 mm. longa, pedunculi, pedicelli et bracteae pubescentes; pedunculi ad 4 mm. longi, pedicelli 3–4 mm. longi, bractae 0.5–1 mm. longae, longe pubescentes, integrae, obtusae; flores immaturi 3–4 mm. longi, 3–5 mm. lati; sepala 4–5, plerumque 5, 1.5–2 mm. longa, antheris 0.75–1 mm. longis, lanceolato-ovatis, breve pubescentibus, longitudinaliter dehiscentibus, breve apiculatis; pistillum 2–2.5 mm. longum, confertim longe pubescens, 4-loculorum (?); stylus apice quadripartitus, glabratus. Capsula 2–2.5 cm. longa, valvae plerumque 4, 2.5–3.5 mm. crassae, extus dense spinosae; spinae 6–8 mm. longae, parce tomentosae, parce curvatae; semen 1 (?).

Although *S. spathulata* is known only from two collections, there is no doubt of its distinctness as a species. The distinct foliage with its very short petioles, the short-spined fruit and the short inflorescences are only approached in *S. rufa* Pl. ex Benth. The latter species differs in its broader leaves with longer petioles, and, in particular, in the much longer staminal awn.

The range of the new species may be extended eventually into the Guianas and probably also down the main Amazon basin although the present material has come only from the Territory of Acre in western Brazil (see Map 2).

Brazil: Territory of Acre: Near mouth of Rio Macauhan (tributary of Rio Yaco): *Krukoff 5337* (fr.) Aug. 8, 1933 (A (Type), F, G, K, MO, NY, US); *Krukoff 5393* (fl.) Aug., 1933 (A, K, MO, NY, US).

10. **Sloanea rufa** Planchon ex Bentham, Journ. Linn. Soc. **5:** suppl. 68. 1861.

S. longicaudata Ducke, Bol. Tech. Inst. Agron. do Norte **19:** 14. 1950.

Tree small, to 7 m. high (*fide* Klug). Branchlets gray-brown, bark scaling off in flakes; twigs stout, densely cinnamon-pubescent. Leaves crowded near the ends of the twigs, stipules subpersistent, 4–12 mm. long, 2–7 mm. wide, ovate, densely pubescent, margin deeply laciniate; petioles 0.8–7.5 cm. long, robust, terete to somewhat canaliculate above, at times moderately incrassate at base and apex, densely rufous-tomentose: blade 11–32.5 cm. long, 5.5–27 cm. wide, elliptical to obovate, coriaceous, midrib and secondary veins impressed, densely pubescent becoming glabrate toward the margin above, midrib, secondary, and tertiary veins prominent, densely rufous-tomentose beneath, base of blade rounded to cordate, apex short-acuminate, acute to obtuse, margin irregularly but scarcely repand-dentate, at times teeth sur-

mounted by small spine which may be glabrous or densely hirsute. Inflorescence 1.5–3 cm. long, 5–9–flowered, peduncles, pedicels and bracts densely pubescent; peduncles 1–2 cm. long, pedicels 3–10 mm. long, bracts 1–3 mm. long, 1 mm. wide, ovate to obovate, laciniate; flowers 5–7 mm. long, 5–8 mm. in diameter, pale-green or greenish-yellow; sepals 2–3 mm. long, 1.5–2.5 mm. wide at the base, more or less ovate, subacute, strongly pubescent without, pubescent toward the margin within; stamens 2–4 mm. long, the outermost often filiform staminodia, filaments 1.5–2.5 mm. long, densely long-pubescent, anthers 0.25–0.75 mm. long, scarcely wider than the connective on the ab- and adaxial sides, densely long-pubescent, connective prolonged into a glabrous filiform awn 0.75–1.5 mm. long; pistil 4–6 mm. long, ovary 2–2.5 mm. long, 4-angled, 4-loculed, densely pubescent, style 3–4 mm. long, more or less deeply 4-parted at the apex, twisted or straight, becoming glabrous in the upper ⅓–⅔ of its length. Capsule probably about 2–2.5 cm. long, 4-valved (?), 1-seeded (?), valves to 1.5 mm. thick, very densely covered without by semirigid spines about equal in length; spines ca. 4 mm. in length, clavate, scattered-hispid-pubescent.

Sloanea rufa Pl. ex Benth. is a very distinct species with leaves crowded at the ends of the twigs as in *S. spathulata* and *S. granulosa*, but the dense pubescence separates *S. rufa* as do the long-awned stamens, laciniate stipules and the shorter-spined capsules. In the type-specimen, the ovaries are much larger (to 3 mm. long and 2–3 mm. in diameter) than in the other specimens seen because of growth after anthesis. *S. rufa* is called "urucu rana" in Brazil.

Although present collections indicate that *S. rufa* has a wide range (from French Guiana to Peru) it has been infrequently collected (see Map 2).

French Guiana: Cayenne, *Martin s. n.* (Type-collection) (fl. past anthesis) (K). Brazil: Amazonas: Rio Urubú entre as cachoeiras Lindoia e Iracema, *Ducke 2112* (Type-collection, *S. longicaudata*) (fl.) Sept. 26, 1941 (BI); São Paulo de Olivença, *Fróes 20763* (fr.) Apr., 1945 (BI, NY); Rio Negro, Paduiry Tapera, *Fróes 22715* (fr. immature) Nov. 2, 1947 (BI). Peru: Loreto: Mishuyacu near Iquitos, *G. Klug 53* (fl.) Oct.–Nov., 1929 (US).

10a. **Sloanea Duckei** C. E. Smith spec. nov.

Arbor (?). Cortex ramulorum fulvus, asper; surculi robusti, puberuli vel glabrati. Folia ad terminum surculorum congesta; petioli ad 12 mm. longi, striati, glabrati, apice et basi incrassati; lamina 12–16 cm. longa, 8.5–11 cm. lata, anguste obovata, coriacea, nervus primarius et nervi secundarii supra obscuri, glabri, subtus prominentes, glabri, basi obtusa, apice rotundata, pauce undulata. Inflorescentia ad 3.5 cm. longa, pedunculi, pedicelli et bracteae pubescentes; pedunculi ad 3 cm. longi, pedicelli 3–8 mm. longi, bracteae ad 1 mm. longae, ad 1 mm. latae, triangulares, obtusae; flores (post anthesin) ad 4 mm. longi, ad 3 mm. lati, sepala 5–7, inaequalia, 1.5–2 mm. longa, 0.5–1.5 mm. lata, deltoidea vel lanceolata, obtusa, extus puberula, intus glabrata vel sparse puberula; stamina ad 3 mm. longa, filamenta ad 1 mm. longa, pubescentia, antherae ad 0.5 mm. longae, pubescentes, apiculatae, apiculus ad 1.5 mm.

longus, filiformis, glaber; pistillum ad 3 mm. longum, ovarium ad 1 mm. longum, ovoideum, pubescens, 4-loculare, stylus ad 2 mm. longus, apice quadripartitus, glaber. Capsula (immatura) ad 1 cm. longa, ellipsoidea, valvae 4, ad 1 mm. crassae, extus dense spinosae; spinae ad 2 mm. longae, antrorse pubescentes cum pilis longis, nitidis. Semen ignotum.

Sloanea Duckei was originally described from a single specimen with both flowers and fruits. Two additional collections have since been seen. It is very distinct from *S. rufa*, although the long-awned stamens and the capsules with short spines are indicative of the close relationship of these two species. This species is distinguished from *S. rufa* by the glabrous foliage and the much smaller capsules. It is a pleasure to name this species after the most outstanding modern student of the Amazon flora.

S. Duckei is endemic to the Amazonas region of Brazil (see Map 2).

Brazil: Amazonas: Rio Curicuriary, af. do Rio Negro, *Ducke*, Herb. Jard. Bot. Rio de Janeiro 34986 (fl. & fr.) Feb. 22, 1936 (RB (Type)); Alto Tapajos, Vila Nova, parto do Cachoeira do Chacarão, *Pires 3943* (fr.) Jan. 17, 1952 (GH); São Paulo de Olivença, *Ducke s. n.* (fl. past anthesis) Nov. 23, 1940 (BI).

11. **Sloanea granulosa** Ducke, Bol. Tech. Instit. Agron. do Norte **19:** 13. 1950.

Very tall tree with large radiating buttresses (*fide* Ducke). Branchlets with finely striate, gray-brown bark; twigs robust, densely pubescent. Leaves borne toward the ends of the twigs, but not densely crowded, alternate; stipules at times subpersistent, to 2 mm. long, 0.75 mm. broad at the base, deltoid-lanceolate, acute, short-pubescent; petioles 8–15 mm. long, scarcely striate, subcanaliculate above, short-pubescent to glabrate, slightly incrassate at base and apex; leaf-blades 9–14 cm. long, 4.3–9 cm. wide, elliptic to obovate, coriaceous, midrib, secondary and tertiary veins impressed, short-pubescent to glabrate above, prominent, thinly short-pubescent with scattered long hairs along the midrib beneath, base subacute to rounded, apex obtuse to emarginate, at times mucronate, margin more or less irregularly undulate, occasionally with small blunt processes on the margin terminating the tertiary veins. Inflorescences 1.5–2 cm. long, 3–7-flowered; peduncles, pedicels and bracts densely short-pubescent; peduncles 1–4 mm. long, pedicels 4–12 mm. long, bracts 1–2 mm. long, 0.5–1 mm. wide, subnavicular, deltoid-lanceolate, occasionally few-dentate, subacute; flowers cream, 4–9 mm. long, 4–5 mm. in diameter, sepals 4–5, 1.5–2 mm. long, 1–2 mm. wide at the base, ovate to lanceolate-ovate, densely short-pubescent without, glabrous within, subacute or acute; stamens 1.5–2.5 mm. long, filaments 0.75–1.5 mm. long, filiform, moderately pubescent, anthers 0.75–1.5 mm. long, elliptic or obovate with cordate base, very short-pubescent, connective prolonged into a short stout glabrous awn: pistil 4–7 mm. long, ovary about 2 mm. long, 2 mm. in diameter, subglobose, indistinctly 4-angled, 4-loculed, densely pubescent, style 3–4 mm. long, straight or twisted, generally deeply 4-parted, (the branches at times unequal in length), pubescent on the basal ⅓, glabrous above. Capsule about 3.5 cm. long, 2.5 cm. in diameter, ovoid, 1-seeded, 4-valved; valves

4–5 mm. thick, smooth and red inside, granulose and densely fine-pubescent without. Seed ellipsoidal, 17 mm. long, 8 mm. in diameter, covered to the funiculus with a fimbriate, 5-lobed red aril which is firmly attached to the chalazal ⅓ of the seed.

Sloanea granulosa Ducke is readily separated from *S. rufa* by the long pedicels and the granulose fruits. Two sheets of this material collected by R. Pearce and deposited in the Kew Herbarium list only "Monterico" as the locality. The collector is probably Richard William Pearce who collected in Chile, Peru and Ecuador during the latter half of the 19th century. At the present time the only Monterico in this area is located on the Río Marañon in Peru, a part of the upper Amazon drainage.

This species is probably to be found throughout the Amazon basin although the present collections have come from widely separated areas in Pará, and Amazonas, Brazil and probably from Peru (see Map 2).

BRAZIL: PARÁ: Belém: Catú, *Ducke 1656* (Type-collection) (fl. & fr.) Nov. 21, 1944 (A, BI, NY, RB, US); *Fróes 20783* (fl. & fr.) Nov. 22, 1944 (BI, K, NY); AMAZONAS: Manáos, estrada do Aleixo, *Ducke s. n.* (fr.) Mar. 31, 1945 (BI). PERU: (?) Monterico, *R. Pearce s. n.* (fr.) Mar., 1867 (K).

12. **Sloanea brevispina** C. E. Smith spec. nov.

Arbor ad 30 m. alta. Cortex ramulorum cinereo-fulvus vel fulvus, striatus, asper; surculi robusti, pubescentes vel glabri. Stipulae caducae, parvae, triangulatae; petioli 2.5–9 cm. longi, parce pubescentes vel glabri, plerumque striati, supra subcanaliculati; lamina 6.5–28 cm. longa, 5.5–14 cm. lata, ovata vel elliptico-ovata, coriacea; nervus primarius et nervi secundarii obscuri, supra subimpressi, glabri, subtus fortiter prominentes, glabri, nervi secundarii ascendentes ad marginem fortiter arcuati; basi subobtusa vel obtusa vel truncata vel cordata, apice breve acuminata, obtusa vel emarginata; inaequaliter undulata, apice saepe repando-dentata. Inflorescentia 2–3.5 cm. longa, flores ad 4 mm. longi, ad 4 mm. lati; sepala 7, inaequalia, ad 0.75–1 mm. longa, ad 0.75-1 mm. lata, anguste ovata, acuminata, acuta, paullo subdentata, extus paullo breve pubescentia, intus glabra; stamina 2.5–3 mm. longa, filamenta 1.75–2.5 mm. longa, confertim pubescentia; antherae ad 0.75–1 mm. longae, ellipsoideae, breve pubescentes, apice pilis longioribus, longitudinaliter dehiscentes, breve apiculatae; pistillum (immaturum?) ad 1 mm. longum, ovarium ad 0.5 mm. longum, longe pubescens, 4-loculatum, stylus glaber, apice saepe quadrifidus. Capsula ad 3 cm. longa, 1.5–2 cm. lata, ellipsoidea, valvae 3–4, plerumque 4, ad 4 mm. crassae, extus densissime spinosae; spinae 2.5–3 mm. longae, inaequales, clavatae, antrorse hispidae. Semina 1–2, arillus trilobatus, ruber, ad terminum chalazalem firme adhaerens.

The dark leaf-venation strongly arcuate toward the margins, the longer petioles, the larger number of sepals, the densely fine-spiny fruit and the 3-lobed aril distinguish *S. brevispina* from *S. granulosa*, *S. robusta*, and *S. brevipes*. This is a tree of higher

elevations whereas most species of *Sloanea* occur in the lowland rainforests. The tree is commonly known as "durote" in Venezuela and as "palo León" or "achioté de monte" in Colombia where the wood is considered of good quality.

S. brevispina is known only from the uplands of Venezuela and Colombia where it occurs at elevations from 900 to 2500 meters (see Map 8).

VENEZUELA: Aragua, Parque Nacional: Fila de El Paraíso (Pico Periquito), *Pittier 15562* (fl. & fr.) Sept., 1947 (US, VEN); selvas altas de La Mesa (hoya de El Limón) *Pittier* and *Navichenovich 15704* (fr.) Jan. 17, 1948 (VEN); MONAGAS: Southwest of Caripe, *Steyermark 61977* (fr.) Apr. 9, 1945 (F, VEN); TRUJILLO: Palmira, *E. Delgado 359* (fr.) Apr. 20, 1944 (US, VEN). COLOMBIA: Valle del Cauca, Popyan, *Lehmann 10043* (fr.) Oct., 1901 (A, GH (Type), K, L); ANTIOQUIA: Jericó, *H. Daniel 3489* (fr.) (COL, GH, US); EL VALLE: hoya del Río Cali *Duque 88* (fr.) Feb. 17, 1937 (US).

13. **Sloanea Massoni** Sw., Fl. Ind. Occ. **2:** 938. 1800.
S. truncata Urb., Notizblatt **8:** 26. 1921.
S. dentata var. *Massoni* (Sw.) Stehlé, Carib. For. **8:** 303. 1947.
S. Aubletii Sw. (?), Flor. Ind. Occ. **2:** 940. 1800, in part.

Large tree to 30 m. tall, trunk with large buttresses. Branchlets with rough brown bark; twigs robust, glabrate to short-brown-puberulent, often striate. Leaves may be somewhat crowded toward the ends of twigs or spaced along twigs, alternate; stipules to 3.5 mm. long, 0.75 mm. wide at the base, lanceolate, obtuse, brown-pubescent; petioles 2–10 cm. long, terete toward the base, subcanaliculate toward the apex, incrassate at both ends, striate, often marked with rings, glabrate to scantily brown-puberulent; blades 10-37.5 cm. long, 6.5–22 cm. wide, ovate to oval to obovate, coriaceous, midrib and secondary veins impressed, glabrous to puberulent above, prominent, glabrate to scantily puberulent beneath, base infrequently subacute, generally rounded-obtuse to cordate, apex obtuse, frequently emarginate, long-acuminate-acute only in the large leaves of the young seedling, margin entire to irregularly undulate. Inflorescences 2–3 cm. long; peduncles, pedicels and bracts moderately pubescent; peduncles 1–2 cm. long, pedicels 3–11 mm. long, bracts 1.5–2 mm. long, about 1 mm. wide, ovate, navicular, entire or few-dentate, obtuse; flowers 8–10 mm. long, 8–9 mm. wide (exclusive of the long-exserted stamens), sepals 3–3.5 mm. long, 0.75–1 mm. wide at the base, sparsely pubescent without, glabrous within, lanceolate, entire, acute; stamens long-exserted, 7–9 mm. long, filaments 6–8 mm. long, glabrous, expanding at the apex into a wide connective bearing small anther-sacs about 1 mm. long, connective continued in a short knob above the anthers; pistil 7–9 mm. long, ovary 2–3 mm. long, ovoid, generally 4-loculed, becoming 4-angled after anthesis, densely pubescent, gradually prolonged into the style, style 5–6 mm. long, pubescent at the base, glabrous above, deeply 4-parted. Capsule 2–3 cm. long, ellipsoidal, 5- or, more commonly, 4-valved, the valves 2-4 mm. thick, the surface densely puberulent with longer shining hairs, densely covered with flexible spines 7–12 mm. long, spines generally straight, gradually tapered to the apex, scantily antrorse-hispidulous. Seed enclosed in a 5-(?) lobed aril which is firmly attached to the chalazal ⅓ of the seed.

Sloanea Massoni Sw. is a very distinct species of the Lesser Antilles which has been generally known under the name *S. sinemariensis*. The Swartz name had become lost, having generally been assumed to be applied to an endemic species of St. Kitts. Urban realized the distinction between the present species and the Aublet species of South America and renamed it *S. truncata* in 1921. Because I had seen only material referable to either *S. dentata* or *S. truncata* from St. Kitts, I wrote Mr. Malcolm Smith asking that he look for the large-leaved "burr wood" which would presumably be *S. Massoni*. Not only did Mr. Smith find the large-leaved species, but his very keen observations in the field detected similar foliage on two distinct species. These he most considerately collected and sent to me together with excellent notes on the plants themselves and on the habitats in which they grow. The specimens from St. Kitts proved to be *S. truncata* and *S. dentata*.

Mr. Smith writes that the large leaves of these species develop on the tops of young trees and on new shoots. Among the material which I received was a specimen of *S. dentata*, which, when it was divided for mounting, filled three herbarium-sheets. The petiole is 7 inches long and a quarter inch in diameter at the thinnest point. The blade itself measures 27 inches long by 16 inches wide. The measurements of this leaf have not been included in the description as fertile specimens always bear smaller leaves, the form normally found on mature shoots.

Dr. Ivan Johnston kindly searched out the original Swartz collection of *S. Massoni* at the British Museum and could refer it only to *S. truncata* and not to *S. dentata* as most authors have inferred. Thus, *S. Massoni* becomes the correct name for a well-known West Indian species.

In regard to *S. Aubletii*, although Swartz clearly states that he is placing *S. sinemariensis* in synonymy with it, his description agrees well with *S. Massoni* from the West Indies. Swartz may not have seen the Aublet material, but described *S. Aubletii* from his own collections. Thus, I am placing *S. Aubletii* in synonymy in part with reservations, as the type-collection has not been examined.

On Guadeloupe where *S. Massoni* is known as "chataignier petite feuille," it is cut for construction timber. It is also known as "ironwood" (Grenada), "petit coco" (Martinique), and "chataignier grande feuille" (Dominica).

Hahn 202 is a mixed collection, the Gray Herbarium sheet being *S. dentata* and the Stockholm sheet *S. Massoni*.

Found throughout the Lesser Antilles from St. Kitts to Grenada, *S. Massoni* is one of the dominant species of the heavily forested upland areas (see Map 8).

ST. KITTS: Belmont Estate, *M. Smith s. n.* (fr.) May, 1952 (GH). MONTSERRAT: Fergus Mountain, *Shafer 344* (fr.) Jan. 30 1907, (F, NY, US); Centre Hills, *Beard 407* (fr.) Nov. 7, 1944 (A). GUADELOUPE: Matouba, bois de la cascade de Varrchet, Hauteurs de Baillif, *Duss 3808* (Type-collection, *S. truncata*) (fl. & fr.) Sept. 15, 1896 (F, MO, NY, US). DOMINICA: Ad Laion, *Ramage s. n.* (fr.) July 5, 1888 (S); Marigot, near the Mantipo River, *Hodge 539* (fr.) July 21, 1938 (GH, NY, US); *Imray 143* (fl. past anthesis) (GH); Carib Trail from Riversdale to Deux Branches, *Howard 11762* (fr.) May 27–June 2, 1950 (GH). MARTINIQUE: Bois de Fons St. Denis du Lorrain, in Camp Balata, *Duss 1369* (fr. & fl.) 1883–4 (F, GH, MO, NY, US); *Hahn 202* (fr.) 1871 (S). ST. VINCENTS: *H. H.* and *G. W. Smith* and *Godman 535* (fr.) Mar., 1890 (GH, NY). GRENADA: Around Grand Etang, *Howard 10636* (fr.) Feb. 24–Mar. 6, 1950 (GH); Bailey's Wood near Soulier, *Broadway s. n.* (fl. past anthesis) Nov. 12, 1896 (NY).

14. **Sloanea curatellifolia** Grisebach, Mem. Amer. Acad. nov. ser. **8**: 164. 1861.

S. longiseta Wright ex Griseb., Cat. Plant. Cub. 30. 1866

Large tree (*fide* Wright). Branchlets with brown, striate bark. Twigs generally robust, somewhat sulcate, sparsely brown-puberulent. Leaves spaced along twigs, alternate, stipules caducous, 3–5 mm. long, 1 mm. wide at the base, lanceolate, entire, acute, densely brown-puberulent, petioles 1.3–2.3 cm. long, finely striate, sometimes ringed, subcanaliculate above, at times incrassate at the apex, glabrous to sparsely puberulent; blade 6.5–16.5 cm. long, 4.5–9 cm. wide, oval to obovate, coriaceous, midrib and secondary veins impressed, sparsely puberulent above, prominent, glabrate to sparsely pilose below, secondary veins straight or scarcely arcuate, base rounded to subacute, apex subacute to obtuse to scarcely emarginate, margin entire to irregularly undulate. Inflorescences generally 1.5–2.5 cm. long, 2–6-flowered; peduncles and pedicels scantily puberulent to puberulent, peduncles 4–15 mm. long, pedicels 3–9 mm. long, bracts 1–2 mm. long, about 1 mm. wide at the base, densely puberulent, generally 2- to 3-dentate at the apex, more or less acute; flowers 5–8 mm. long, 6–8 mm. in diameter, calyx of 4–6 sepals, sepals 2–3 mm. long, 1–3 mm. wide at the base, deltoid to somewhat ovate, sparsely puberulent both within and without, becoming more densely puberulent at the margins, acute or, at times, acuminate-acute; stamens exserted, 3–4 mm. long, filaments 2–3 mm. long, densely ascending-pubescent; anthers 0.75–1 mm. long, deltoid, densely short-pubescent, connective prolonged into a short knob often with a ring of hairs around its base; pistil 4–5 mm. long, ovary 1.5–2.5 mm. long, ovoid, densely pubescent, 2–4- generally 3-locular, style 2–3 mm. long, 2–4- commonly 3-parted at the apex, pubescent almost or entirely to the obtuse apex. Capsule 1.75–2 cm. long, ellipsoidal, often opening almost flat to disclose the red interior, 3–4-valved, the surface of the valves velvety-tomentose, densely covered with flexible spines; spines 9–30 mm. long, reddish, densely ascending-pilose, abruptly subacute. Seed not seen.

Sloanea curatellifolia is an endemic species of Cuba which is similar to *S. Massoni* in its 4–6 sepals, exserted stamens and

general leaf-arrangement and texture. It differs markedly in sepal-shape, pubescence of filaments, parting of the style and length of spines of the capsules. Although only a few flowering specimens of *S. ilicifolia* from the Dominican Republic and Haiti have been seen, the floral characters and the capsule-characters of these two species are similar.

S. curatellifolia is known only from the Oriente region of Cuba (see Map 8).

CUBA: Monte Verde, *Wright 1118* (Type-collection, *S. curatellifolia* and *S. longiseta*) (fl. & fr.) Mar. 13, 1859 (GH, MO, S); Loma del Gato, *Clement 4251* (fr.) Aug., 1944 (US); ORIENTE: Moa, *Clement 3554* (fl.) May 15, 1944 (US); Sierra de Nipe ad Río Piloto, *Ekman 5990* (fr.) June 10, 1915 (S).

15. **Sloanea ilicifolia** Urban, Fedde Rep. Spec. Nov. **18:** 365. 1922.
S. castor Urban & Ekman, Arkiv. Bot. 22A; **17:** 26. 1929.

Tree 15–20 m. tall. Branchlets with brown or gray-brown bark, scarcely striate to rough. Twigs more or less sulcate, scarcely to densely brown-puberulent. Leaves alternate to opposite, often clustered on many small twigs toward the ends of the branchlets; stipules 3.5–4.5 mm. long, linear-lanceolate, light-brown-pubescent; petioles 3–12 mm. long, terete, scarcely incrassate at both ends, light-brown-puberulent; blade variable in size and shape, 3.5–12.5 cm. long, 2.2–9.5 cm. wide, elliptic-lanceolate to broadly oval, stiff-coriaceous, midrib and secondary veins impressed, scantily puberulent to glabrous above, prominent, puberulent to glabrous beneath, secondary veins 4–8, irregularly arcuate-ascending, terminating in a spine at the leaf margin, tertiary venation irregular, occasionally terminating in a marginal spine, base rounded to cordate, apex rounded to short-acuminate to acute, the midrib prolonged into a spine, margin irregularly and deeply spinose-dentate. Inflorescences axillary, often at leaf-scars, one- to several-flowered; flowers 3–4 mm. long, about 4 mm. in diameter, sepals generally 6, to 5 mm. long, 0.5–1.25 mm. wide at the base, lanceolate-deltoid, obtuse, densely puberulent within and without; stamens 2–3 mm. long, filaments 1.5–2 mm. long, puberulent to pubescent, anthers 0.75–1 mm. long, deltoid, puberulent, dehiscing linearly most of their length, connective prolonged into a short knob above the anther-sacs; pistil to 3 mm. long, ovary 1–2 mm. long, densely pubescent, indistinctly 4-angled, 4-loculed, gradually giving rise to the style, style often divided to the ovary to form two parts, each of which is divided again at the apex, pubescent at the base, glabrous above. Capsule brown, 1.5–1.75 cm. long, 1.25–1.5 cm. in diameter, subglobose to ellipsoidal, 1-loculed, 1–2-seeded, 3–4-valved; valves with velutinous outer surface densely covered with flexible spines; spines to 1.5 cm. long, densely antrorsely puberulent, straight, abruptly acute. Seeds enclosed almost completely in a deeply 3-lobed red aril which is firmly attached to the chalazal ¼ of the seed.

Sloanea ilicifolia Urb. is an endemic of Hispaniola readily distinguished by its ilicioid foliage. Aside from the foliage, this species is closely related to *S. curatellifolia* of Cuba as is shown by the similarly pubescent stamens, and the style parted almost to the ovary.

S. ilicifolia was described by Urban in 1922. The species first came into botanical literature as plates depicting a sterile, ilicioid-leaved shoot in both Plukenet and Plumier. The latter author referred the plant to *Malpighia.* These plates were cited with the description of *S. ilicifolia* by Urban. Swartz had described a species of *Valentinia* (*V. ilicifolia*) citing in synonymy the plates mentioned above. Through this mistake in judgment, *S. ilicifolia* became badly confused with *Casearia ilicifolia* Vent. and *C. comocladifolia* Vent. Only recently has this entanglement been rectified by R. A. Howard and myself (1953). So far as I can determine, the sterile twigs pictured by Plukenet and Plumier are referable only to the present species.

S. ilicifolia is endemic to the mountain forests of Hispaniola at elevations of 200 to 1300 meters (see Map 8). Foliar variation is great, but the flowers and fruit are indistinguishable in the specimens cited.

HISPANIOLA: DOMINICAN REPUBLIC: BARAHONA: Monteada Nueva, S. E. of Polo, *Howard 12355* (fr.) Aug. 3, 1950 (GH); AZUA: Cordillera Central, Las Lagunas, *Ekman H-6366* (fl. past anthesis) July 13, 1926 (S); HAITI: Fonds Varettes, *E. C. Leonard 3797a* (Co-type, *S. ilicifolia*) (st.) Apr. 17–May 4, 1920 (NY, S); Massif de la Hotte, western group: Les Roseaux at Nan-Patates, *Ekman H-10690* (Type-collection, *S. castor*) (fl. & fr.) Sept. 17, 1928 (S, US): Torbec, La-Marie-Proux, *Ekman H-5399* (st.) Dec. 8, 1925 (S); Rivière Glace, *Holdridge 2219* (fl. & fr.) Aug. 7, 1945 (US).

16. **Sloanea sinemariensis** Aubl., Pl. Guian. 534, tab. 212. 1775.
S. Aubletii Sw., Fl. Ind. Occ. **2:** 940. 1800, in part.

Tree to 18 m. tall; trunk to 16 cm. in diameter (*fide* Krukoff) with buttresses (*fide* Black and Pires). Branchlets with brown or gray-brown scarcely striate bark. Twigs robust, fuscous-puberulent, more or less sulcate. Leaves clustered toward the ends of the twigs, alternate to subopposite; stipules to 3 mm. long, and 1.5 mm. wide at the base, densely puberulent, deltoid-lanceolate; petioles 3.5-8.5 cm. long, subterete, puberulent to glabrate, scarcely striate, more or less incrassate at both ends; blade 15–33.5 cm. long, 12–21 cm. wide, elliptic, ovate or broadly oval, coriaceous, midrib and secondary veins impressed, brown-puberulent above, prominent, scattered-pubescent beneath; secondary veins 9–11, arcuate-ascending, often abruptly and strongly curved near the margin; base rounded to obtuse, apex emarginate to generally rounded, margin irregularly undulate to repand-dentate especially toward the apex. Inflorescences 2–6 cm. long (those on the Aublet voucher very immature), peduncles, pedicels and bracts moderately puberulent, peduncles 1–5 cm. long, pedicels 0.9–2 cm. long, tapering upward; bracts 1–2 mm. long, to 1 mm. wide at the base, deltoid, subacute or obtuse; flowers (past anthesis) 8–9 mm. long, ca. 7 mm. in diameter; sepals 5–6, often with one sepal smaller as indicated in the type-description, 3–4 mm. long, 0.75–3 mm. wide at the base, ovate to subobovate, obtuse to more or less acute, margin occasionally obscurely dentate, striate-pubescent without, scattered-pubescent to glabrate

within: stamens 3 mm. long, filaments 1.5–2 mm. long, long-pubescent, anthers about 1 mm long, lanceolate, pubescent, connective prolonged into a short awn; pistil (past anthesis) 8–9 mm. long, ovary 3–4 mm. long, ellipsoidal, densely velutinous-pubescent, more or less angled, 3–5-loculed, style 3–4.5 mm. long, rising abruptly from the ovary, pubescent at the base, glabrous above, deeply 3–5-parted. Capsule 2–2.3 cm. long, 0.7–1 cm. in diameter, ellipsoidal, 3–5- generally 4-valved, 1-locular, 1-seeded; valves recurving when dehisced, 1.5–2 mm. thick, densely covered with flexible spines; spines 3–5 mm. long, antrorsely pubescent. Seed unknown.

There has been much confusion over the identity of *S. sinemariensis* Aubl. This has been due to two factors: (1) the close similarity of several species in this complex; (2) the tendency among early 19th century botanists to broaden the original species-concept to include many specimens which did not agree with the specimen originally described so long as they had the same general aspect.

In considering the first factor, characters common to several species such as the ellipsoidal angled ovary, the stamens exceeding the sepals, the inflorescence shorter than the petioles, and the large leaf-blades have all tended to obscure the identity of *S. sinemariensis*. Until recently, this species has existed only as a single sheet in the British Museum where it is available to those botanists who can visit the Museum in person. Furthermore, Aublet collected very immature flowering material in which the anthers were well-developed, but the filaments, pedicels and peduncles had not elongated. Thus, the description of the anthers as longer than the filaments, and the very short inflorescences, while correct, does not describe the mature condition.

The second factor is largely self-explanatory. Aublet's brief description, although perfectly correct, allows a much broader interpretation of the species-limit than in actuality exists in nature. Much West Indian material with long-exserted stamens, long-petioled leaves, and with fruit of a similar size and similarly armed has been called *S. sinemariensis*. On critical examination this is readily identified as *S. Massoni* Sw.

Material from the Guianas and Brazil has been wrongly named *S. sinemariensis*. Most of this material is referable to *S. Eichleri* Schum. which has 6–9 calyx-segments of a smaller size, leaves which are generally densely short-puberulent on the under surface, and fruit with fewer and longer spines.

S. sinemariensis has been collected only in French Guiana and the Amazon basin of Brazil (see Map 8).

FRENCH GUIANA: *Aublet s. n.* Photograph and leaf rubbings with notes from the type-collection in the British Museum (GH); *C. S. Parker s. n.* (K). BRAZIL: PAR.: João Coelho, *Black* and *Pires 50-8633* (fr.) Jan 7, 1950 (BI); AMAZONAS:

Municipality São Paulo de Olivença near Palmares: *Krukoff 8397* (fr.) Sept. 11–Oct. 6, 1936 (F, K, MO, NY); *Krukoff 8450* (fl.) Sept. 11–Oct. 6, 1936 (F, MO, NY, S).

17. **Sloanea pubescens** (Poepp. & Endl.) Benth., Journ. Linn. Soc. **5:** suppl. 69. 1861.

Dasynema pubescens Poeppig and Endlicher, Nov. Gen. et Spec. **3:** 74, tab. 284. 1845.

Sloanea egensis Radlk., Sitzb. Math.-Phys. Akad. Muench. **12:** 329. 1881.

S. pseudodentata Ducke, Archiv. Inst. Biol. Veg. Rio de Janeiro **2:** 159. 1935.

S. xylocarpa Rusby, Mem. N. Y. Bot. Gard. **7:** 294. 1927.

Medium-sized tree (*fide* Ducke). Branchlets with brown, striate bark. Twigs generally robust, more or less sulcate, brown-puberulent becoming glabrate. Leaves evenly spaced along twigs, opposite; stipules 1.5–2 mm. long, densely puberulent, deltoid to deltoid-lanceolate, obtuse; petioles 2–10 cm. long, more or less terete, striate, incrassate at both ends, puberulent; blades 10.5–33.5 cm. long, 8.5–21 cm. wide, oval to obovate, coriaceous, midrib and secondary veins puberulent to glabrate, more or less impressed above, prominent, densely pubescent or puberulent beneath; base obtuse to rounded, apex rounded to short-acuminate-acute, margin irregularly undulate to repand-dentate, especially near the apex. Inflorescences 2–7 cm. long; peduncles, pedicels and bracts puberulent to tawny-pubescent; peduncles 1 -5.5 cm. long, more or less striate, pedicels 3–17 mm. long, bracts 1–3 mm. long, to 1.5 mm. wide at the base, ovate to deltoid to deltoid-lanceolate, obtuse to subacute; flowers 4–7 mm. long, 6–12 mm. in diameter, white to yellow, fragrant; sepals 5–6, 2.5–4 mm. long, 1–3 mm. wide at the base, lanceolate to, generally, ovate, more or less striate, pubescent, becoming more so toward the apex without, sparsely pubescent within, acute to acuminate-acute, margin entire; stamens exserted, 3–6 mm. long, filaments 2–4 mm. long, pubescent, anthers 0.5–1 mm. long, elliptical-lanceolate, pubescent, with a tuft of longer hairs at the apex, connective wide between the anther-sacs on the abaxial side, prolonged into a glabrous awn ¼ to ½ as long as the anther-sacs; pistil 5–7 mm. long, ovary 2–3 mm. long, to 2 mm. in diameter, ovoid, rounded-angular, 4–5-loculed, densely velutinous, style to 5 mm. long, arising gradually from the ovary, 4–5-parted at the apex, often contorted, pubescent on the basal ½, glabrous above. Capsule 1.8–2 cm. long, about 1.3 cm. in diameter, subglobose to ellipsoidal, 4-valved; valves 1.5–2 mm. thick, densely puberulent on the surface, moderately covered with semi-flexible, somewhat curved spines arising from tubercles on the capsule-surface; spines tapering abruptly at first, then more gradually to the subacute apex. Seed not seen.

Sloanea pubescens (Poepp. & Endl.) Benth. is easily separated from *S. sinemariensis* by the opposite leaves, long-awned stamens, and the longer-spined capsules. It is separated from *S. gracilis* primarily by its generally larger size. Subsequent collections may show that *S. gracilis* Uitt. is synonymous with *S. pubescens*, but the specimens now available do not show intergradation of the two species.

Although *S. pubescens* has been collected principally in the Amazon region of Brazil, it has been found to the westward in Colombia and northward in Dutch Guiana, and is to be expected from the other countries bordering the Caribbean (see Map 8).

DUTCH GUIANA: Brownsberg, arbor 1222 (fl.) Oct. 12, 1931 (MO). COLOMBIA: VAUPÉS: Alto del Vaupés, "La Jirisa" y sus alrededores, *Gutierrez V.* and *Schultes 585* (fl. past anthesis & fr.) Jan. 8–10, 1944 (GH). BRAZIL: PARÁ: Rio Branco de Obidos loco Cacaoa-lindo, *Ducke*, Herb. Jard. Bot. Rio de Janeiro 12370 (Type-collection, *S. pseudodentata*) (fl.) Nov. 1, 1919 (US); AMAZONAS: Ega, *Poeppig 2662-B* (Type-collection, *Dasynema pubescens*) (fl.) 1831 (F, G, GH); Porto Curucuí, Rio Negro, *Fróes 21135* (fl.) Oct. 9, 1935 (BI, F, K, NY). BOLIVIA: Tumapasa, Dec. 9, 1921 (fr) *Cardenas 1979* (NY, Type coll. *S. xylocarpa*)

18. **Sloanea gracilis** Uittien, Rec. Trav. Bot. Néerl. **22:** 356. 1925.

Tree. Branchlets with brown, more or less striate bark. Twigs striate, brown-puberulent. Leaves opposite, spaced along twigs; stipules to 1 mm. long, deltoid-lanceolate, brown-puberulent; petioles 2–4 cm. long, subterete to more or less canaliculate above toward the apex, brown-puberulent to glabrate; leaf-blades 7–25.5 cm. long, 3.5–10 cm. wide, elliptical to obovate, chartaceous, midrib puberulent to glabrous above, midrib, secondary veins and tertiary veins prominent, puberulent to pubescent beneath, secondary veins 6–12, arcuate-ascending, base of blade acute or subacute, apex obtuse to acuminate-obtuse to acuminate-acute, margin entire to somewhat wavy-dentate, particularly toward the apex. Inflorescences 1, 2–3 cm. long, peduncles, pedicels and bracts puberulent, peduncles 3–20 mm. long, pedicels 2–8 mm. long, bracts 1–1.5 mm. long, deltoid to lanceolate-subacute; flowers 7–9 mm. long, 5–7 mm. in diameter, sepals 5–7, 2–3 mm. long, 0.5–1.5 mm. wide at the base, puberulent to scattered-puberulent without, glabrate within, deltoid to lanceolate, subacute, entire; stamens 2.5–4 mm. long, filaments 1.5–3 mm. long, puberulent, anthers about 1 mm. long, lanceolate, pubescent, connective broad on the abaxial side, prolonged into a glabrous awn ⅓ to ½ the length of the anther-sacs; pistil 3–7 mm. long, ovary to 1.5 mm. long, ovoid, generally 4-angled, densely pubescent, 4-loculed, style 5–6 mm. long, glabrous except at the base, generally 4-parted at the apex, often contorted. Immature capsules generally 4-valved; valves velutinous on the surface with flexible spines to 3 mm. long.

Sloanea gracilis Uitt. is distinguished from *S. pubescens* primarily by the smaller size, the more lanceolate foliage, and the more distinctly angled ovary. This species may prove to be only a variant of *S. pubescens* but the few available specimens of these species do not show sufficient intergradation to unite them at this time.

I have seen only three collections of *S. gracilis* from widely separated points in Dutch Guiana, Brazil and Bolivia (see Map 7).

Dutch Guiana: Brownsberg, fluv. Suriname, Forestry Bureau 6226 (Type-collection) (fl.) Oct. 5, 1923 (L, US). Brazil: *Burchell 6164* (fl.) (GH). Bolivia: Mapiri región, San Carlos, *Buchtien 1734* (fr.) Dec. 18, 1926 (NY, US).

19. **Sloanea faginea** Standley, Journ. Wash. Acad. Sci. **15:** 478. 1925.

Large tree. Twigs robust, sulcate, short-puberulent. Leaves alternate, borne toward the ends of the twigs; stipules not seen; petioles 1.5–3.5 cm. long, subcanaliculate above, striate, subpuberulent, more or less incrassate at the apex; blade 15–21.5 cm. long, 8.5–13 cm. wide, elliptical-ovate to obovate, midrib and secondary veins subimpressed, minutely puberulent above, prominent, scattered-puberulent beneath, secondary veins 8–10, scarcely arcuate, ascending, base acute, apex rounded, margin undulate to irregularly dentate, especially toward the apex. Flowering inflorescences unknown; single flower seen, pedicel puberulent, flower about 4 mm. in diameter, sepals 7–9, to 3 mm. long, 1.5 mm. wide at the base, lanceolate, subacute, becoming longer in fruit, puberulent without and within; stamens 3.5–5 mm. long, filaments 2.5–3.5 mm. long, puberulent, widening upward to the anther, anther 0.75–1 mm. long, ellipsoidal, puberulent, connective prolonged into a stout glabrate awn about ⅓ the length of the anther-sacs; pistil deformed in flower seen, ovary velutinous, style puberulent almost to the apex. Capsule to 2.5 cm. long, about 1.5 cm. in diameter, ovoid, generally 4-valved, opening flat on dehiscence; valves 3 mm. thick, very densely covered with stout rigid spines; spines to 5 mm. long, puberulent to pubescent. Seed not seen.

Sloanea faginea Standl. is a distinct species endemic to Costa Rica (see Map 7). It is easily differentiated from *S. pubescens* by the 7–9 lanceolate sepals, the distinctive stamens, and the stout short spines densely covering the fruit.

Costa Rica: Peralta: *Stork 483* (Type-collection) (fr.) June, July, 1923 (US); *Stork 481* (fl. & fr. immature) June, July, 1923 (US); Cartago: El Muñeco, south of Navarro, *Standley 33685* (fr.) Feb. 8, 9, 1924 (US); Guanacaste: Los Ayotes, near Tilarán, *Standley* and *Valerio 45343* (fr.) Jan. 21, 1926 (US).

20. **Sloanea Froesii** C. E. Smith spec. nov.

Arbor ad 10 m. alta. Cortex ramulorum fulvus, striatus, asper; surculi robusti, angulato-striati, sparse puberuli. Folia alternata; stipulae caducae, ad 1 mm. longae, triangulatae, puberulae; petioli ad 7.5 cm. longi, teretes, striati, sparse puberuli, saepe transverse annulati; lamina 18.5–29 cm. longa, 12–16 cm. lata, late elliptica, coriacea, nervus primarius et nervi secundarii supra impressi, glabrati, subtus prominentes sparse puberuli; basi obtusa, apice breve acuminata, acuta, inaequaliter subundulata. Inflorescentia (cum fructu) ad 7.5 cm. longa, pedunculus ad 5 cm. longus, striatus, puberulus, pedicellus 1–3 cm. longus, striatus, puberulus, bracteae ad 3 mm. longae, lanceolatae, puberulae; flores (post anthesin) ad 6 mm. longi, ad 7 mm. lati, sepala 7–9, inaequalia, 2–4 mm. longa, 0.5–1.5 mm. lata, lanceolata, extus puberula, intus nervi prominentes, sparse puberula; stamina ad 4 mm. longa, filamenta 2–3 mm. longa, pubescentia, antherae 1.5–2 mm. longae, puberulae, breve apiculatae; pistillum ad 5 mm. longum, ovarium ad 2 mm. longum, 1.5 mm. latum, ellipsoideum, quadrangulatum, puberulum. Capsula (immatura) 12 mm. longa, subglobosa, valvae plerumque 4, extus densissime spinosae; spinae 8–10 mm. longae, sparse puberulae.

Sloanea Froesii is closely related to *S. faginea* as can be seen in the similar sepals and stamens and in the similar capsules with persistent sepals at the base. It is separated from the preceding species by the long petioles and larger foliage, and by the larger capsules with longer spines. Although I have seen but two specimens of this species from the Amazon basin in Brazil, there is no question of its distinctness. Fortunately the type-specimen is quite complete. I take pleasure in naming this species for one of the outstanding botanists of the Instituto Agronómico do Norte at Belém, Pará, Brazil.

S. Froesii has been collected only in the Amazon basin of Brazil (see Map 7).

BRAZIL: AMAZONAS: Rio Solimões, Igarapé Belém, *Fróes 23715* (fr. & fl.) Dec. 15, 1948 (GH (Type)); Esperanza, *Ducke s. n.* (fr.) Jan. 28, 1947 (BI).

21. **Sloanea robusta** Uittien, Rec. Trav. Bot. Néerl. **22:** 350, fig. 7. 1925.

Large tree to 25 m. high; trunk to 50 cm. in diameter (*fide* Cuatrecasas). Branchlets with rough dark-brown bark. Twigs puberulent, more or less sulcate. Leaves alternate, borne toward the ends of the twigs; stipules to 4 mm. long, 1 mm. wide at the base, puberulent, lanceolate-acute; petioles 4–8.5 cm. long, glabrate, subterete, more or less incrassate at both ends, at times ringed; blades 10.5–24.5 cm. long, 9–14.5 cm. wide, elliptical to oval, midrib and secondary veins prominent to subimpressed, glabrate to puberulent above, prominent, glabrous to subpuberulent beneath, base rounded to subcordate, apex rounded, at times abruptly short-acuminate-acute, margin entire to scarcely irregularly undulate. Inflorescences 4–5.5 cm. long, peduncles, pedicels and bracts puberulent to scattered-pubescent, peduncles 3.5–4.5 cm. long, more or less angular, striate, pedicels 3–8 mm. long, striate, bracts 1–3 mm. long, navicular, lanceolate-acute; flowers 6–7 mm. long, about 7 mm. in diameter; sepals 7–9, variable in size and shape, 2–3 mm. long, 0.5–1.5 mm. wide at the base, lanceolate to elliptical to ovate, subacute, puberulent without, glabrate except on the nerves and at the margins within; stamens about 3 mm. long, filaments 1.5–2 mm. long, scarcely minutely puberulent, connective prolonged into a short, obtuse, glabrous awn above the anther-sacs; anthers 1–1.25 mm. long, lanceolate, minutely puberulent; pistil 5–6 mm. long, ovary 2–3 mm. long, about 2 mm. in diameter, ovoid, ridged, densely pubescent, 4–5-loculed, style 3–4 mm. long, deeply 4–5-parted, pubescent at the base, apical ½ glabrous. Capsule to 2.5 cm. long, 1.75 cm. in diameter, ellipsoidal, generally 4-valved; valves to 2 mm. thick, surface often pitted where the spines have fallen; spines densely covering the capsule, reddish-purple, to 2 cm. long, semi-flexible, tapering gradually to the apex, scantily ascending-pubescent. Seed about 12 mm. long, almost covered with a 6-lobed aril; aril firmly attached to the chalazal ½ of the seed.

Sloanea robusta Uitt. is a distinct species with nearly glabrous leaves, 7–9-parted calyx, short-awned, minutely puberulent stamens and large long-spined fruit which separate it from *S. pubescens* and *S. sinemariensis*. *S. faginea* of Central America,

and *S. Froesii* show in their calyx and stamens similarity to *S. robusta*, but the foliage and fruit are very dissimilar. This species is locally known as "pente de macaco" in Matto Grosso, Brazil.

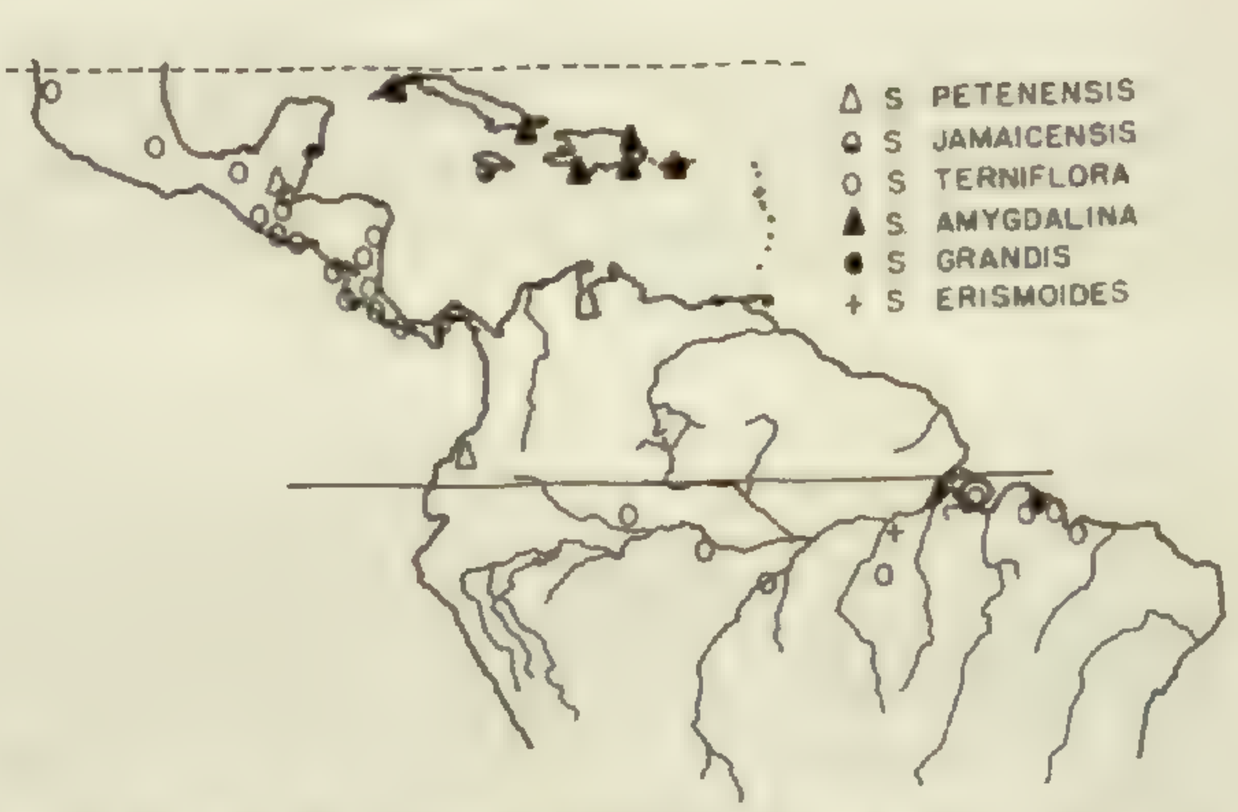
S. robusta occurs in Dutch Guiana, Colombia and the Matto Grosso area of Brazil (see Map 7).

DUTCH GUIANA: Brownsberg, arbor 1070: Rijksherb. 4261 (Type-collection) (fr.) Feb. 24, 1919 (L); Rijksherb. 4009 (fl.) Sept. 16, 1918 (US). COLOMBIA: VAUPÉS: Río Cuduyari, *Allen 3254* (fl. & fr. immature) Jan. 20, 1944 (US); META: Cordillera La Macarena, macizo Renjifo, *Idrobo* and *Schultes 1114* (fr. immature) Jan. 6–20, 1951 (US); EL VALLE: Cordillera Occidental, vertiente occidental, hoya del Río Sanquininí, *Cuatrecasas 15582* (fr.) Dec. 10–20, 1943 (F). BRAZIL: MATTO GROSSO: near Tabajara, upper Machado River region, *Krukoff 1491* (fr.) Nov., Dec., 1931 (A, G, K, NY, S).

22. **Sloanea brevipes** Benth., Journ. Linn. Soc. **5:** suppl. 68. 1861.

Tree to 30 m. high, trunk to 3.1 m. in diameter with enlarged buttressed base (*fide* Steyermark); bark rough, brown; branches spreading (*fide* Schomburgk). Branchlets with rough, gray-brown bark. Twigs stout, brown-pubescent. Leaves generally clustered toward ends of twigs, opposite to alternate; stipules 3–6 mm. long, lanceolate, densely pubescent; petioles 0.5–2 cm. long, subterete, glabrate to densely pubescent; blade 12.5–20.5 cm. long, 6–16 cm. wide, obovate to ovate, coriaceous, midrib and secondary veins subimpressed, puberulent to pubescent above; prominent, pubescent below, secondary veins 9–12, arcuate-ascending, base obtuse to rounded to subcordate, apex obtuse (occasionally emarginate) to more or less acuminate-subacute, margin irregularly undulate to repand-dentate toward the apex. Inflorescences buff-colored, 1.5–3 cm. long; peduncles 1–2.5 cm. long, short-pubescent, often somewhat angled, pedicels 3–10 mm. long, short-pubescent, bracts 1.5–2 mm. long, 0.75–1 mm. wide at the base, deltoid to deltoid-lanceolate, densely pubescent below, sparsely pubescent above; flowers 6–7 mm. long, 5–7 mm. in diameter, sepals light-green, 5–7, 2–3 mm. long, 0.5–1.5 mm. broad at the base, deltoid to lanceolate, acute, scattered-pubescent without, glabrate within; stamens 3–4 mm. long, filaments 1.5–2 mm. long, pubescent, anthers 0.75–1 mm. long, more or less ovoid, puberulent, connective wide on the abaxial side, prolonged into a short, pyramidal, obtuse, glabrous awn; pistil 6–7 mm. long, ovary 1–2 mm. long, 1–1.5 mm. in diameter, ovoid, tawny-velutinous, style 4 mm. long, glabrous, 3–4-parted at the apex, at times somewhat contorted. Capsule to 2.5 cm. long, about 1 cm. in diameter, 4-valved; valves to 3 mm. thick, densely covered with spines to 1 cm. long; spines tapered to the apex, ascending, short-pubescent. Single seed 9–10 mm. long, covered by a 4-lobed aril firmly attached to the chalazal ⅓ of the seed, lobes of the aril undulate-margined.

Sloanea brevipes Benth. with its short petioles, short-awned stamens, and 4-lobed aril on the seed is clearly distinct from other species of *Sloanea* in this group. Apparently Schomburgk split 1021 into two parts at the time he prepared his collections for



MAPS 7–10. Map 7. (upper left), Map 8 (upper right), Map 9. (lower left), Map 10. (lower right).

shipment to England. However, he failed to renumber all of the specimens as 1044. The type-sheet of *S. usurpatrix* at Kew is 1021 (noted by Bentham as the same as 1044 in Herb. Hook.). The type-sheet of *S. brevipes* from Kew is also 1021—thus, this number is a mixed collection and the type of two species, apparently through the collector's error.

No locality data are available for *Schomburgk 1021*, but 1019 is from Rio Padawiri (Rio Negro) and 1022 is from Sta. Isabel (Rio Negro) and 1021 is presumably from the Rio Negro also.

S. brevipes has been infrequently collected in Venezuela, Colombia and the Amazon region of Brazil (see Map 7).

VENEZUELA: BOLÍVAR: Sororopán-tepuí, wooded ridge between quebrada and Salto de Iwaracaru-merú, *Steyermark 60188* (fr.) Nov. 15, 1944 (A, F, VEN). COLOMBIA: CAQUETÁ: Florencia, Quebrada de las Perdices, *Cuatrecasas 8852* (fr. immature) Mar. 29, 1940 (COL, US). BRAZIL: AMAZONAS: Rio Negro (?), *Rob. Schomburgk 1021* (Type-collection) (fl.) (F, GH, K, L, US); Rio Negro, Tapuruquara, *Pires 244* (fr.) Apr. 8, 1947 (GH); near Calama, Madeira River region, *Krukoff 1295* (fr.) Nov., Dec., 1931 (A, G, K, NY, MO, P, S).

23. **Sloanea stipitata** Spruce ex Bentham, Journ. Linn. Soc. **5:** suppl. 68. 1861.
S. Purdiaei Griseb. ex Benth. & Hook., Gen. Pl. **2:** 653. 1876. (Nomen nudum).
S. Maximowicziana Schumann in Mart., Fl. Bras. **12** (3): 192. 1886.

Forest tree. Branchlets with dark-brown bark, lenticels conspicuous. Twigs generally slender, striate to sulcate, glabrous to minutely scattered-puberulent. Leaves opposite or sub-opposite, spaced along twigs; stipules to 1.5 mm. long, lanceolate, puberulent; petioles 2–3 cm. long, striate, canaliculate, incrassate at both ends; blade 11.5–24.5 cm. long, 8.5–13 cm. wide, oval to long-elliptic to obovate, firmly chartaceous, midrib and secondary veins minutely puberulent to glabrous above and below, prominent beneath, secondary veins 9–12, arcuate-ascending, at times more strongly arcuate toward the margin; base subacute to cuneate-acute, apex acuminate-obtuse, margin irregularly undulate to obtuse-dentate, especially toward the apex. Inflorescences 3.5–5 cm. long; peduncles and pedicels minutely scattered-puberulent to glabrate, peduncles 3–4.5 cm. long, pedicels 5–14 mm. long, bracts 1–2 mm. long, 0.5 mm. wide at the base, lanceolate, puberulent; flowers about 8 mm. long, 7 mm. in diameter, sepals 5–7, 4–5 mm. long, 0.75–1.5 mm. wide at the base, ovate to lanceolate, acute to acuminate-acute, minutely scattered-puberulent without, glabrate within; stamens 4–5 mm. long, filaments 2–3 mm. long, pubescent, anthers about 1 mm. long, deltoid-lanceolate, pubescent, connective prolonged into an obtuse awn ⅓–½ the length of the anther; pistil 6–7 mm. long, ovary 2–3 mm. long, 1.5–2 mm. in diameter, ovoid, velutinous, ridged, 4–5-loculed, style 3–4 mm. long, pubescent on the basal ⅓, glabrate above, 4–5-parted at the apex or almost to the ovary, at times contorted. Capsule (immature) 7 mm. long, 3.5–6 mm. in diameter, ellipsoidal to subglobose, markedly stipitate only on *Spruce 3197*, generally 4-valved, somewhat 4-angled; valves velutinous on the surface, densely covered with straight, flexible spines 6–10 mm. long; spines not tapered, antrorsely pubescent, subobtuse. Seed immature.

Sloanea stipitata Spruce ex Benth. is a broader concept with the inclusion of *S. Maximowicziana* Schum. Fragments of flowers from *Spruce 3197* and intermediate forms represented by Traill's and Moore's specimens leave no doubt as to the conspecific nature of the entities involved. The Spruce collection with small leaves and markedly stipitate fruit seems to be an extreme variant in this taxon, although it is difficult to judge which specimen is typical when so few collections are involved. Traill notes that this species is locally known as "acutiresa" on the upper Amazon.

The collections cited from Trinidad and Tobago were labeled *S. Purdiaei* Griseb. However, Grisebach apparently never published a description of this species, and the material which I have cited agrees with the fruiting material of *S. stipitata*. Unfortunately, the one flowering specimen either has buds which are too immature or all of the floral parts except the ovary have dropped from the flowers.

S. stipitata occurs on the islands of Trinidad and Tobago as well as on the continent as far southeastward as Minas Geraes, Brazil (see Map 7).

Tobago: Parlatuviere Road, *R. L. Brooks 12628* (fr.) Feb. 2, 1932 (NY). Trinidad: La Brea, *J. Danouse 6942* (fr.) Mar. 11, 1902 (NY); *Purdie 53* (fr.) (GH); Bot. Gard. Herb. 1116 (fl. past anthesis & immature) (US). Venezuela: Orillas del Merevare, Guayana, *F. Cardona 353* (fl.) Feb. 23, 1940 (US, VEN); Ad flumina Casiquiari, Vasiva et Pacimoni, *Spruce 3197* (Type-collection) (fr.) 1853–54 (F, G, GH, NY). Brazil: Amazonas: Rio Purus, Jurucua, *J. W. H. Traill 72* (fr.) Sept. 25, 1874 (K); Bahía: Ilheos, *Martius s. n.* (fl.) 1853 (GH); Goias: Goiana, *A. C. Brade 15413*, Herb. Jard. Bot. Rio de Janeiro 31231 (fr.) Dec., 1936 (RB); Matto Grosso: *S. Moore 614* (fr.) 1891–2 (NY, K); Santa Anna de Chapada, *Malme 2363* (fl.) Sept. 22, 1902 (S). Espirito Santo: Rio Pancas Colateiro, Rio Doce, *Kuhlmann 6547*, Herb. Jard. Bot. Rio de Janeiro 62900 (fr.) Nov. 20, 1943 (RB). Minas Geraes: Fazenda Santa Terezinha, *Macedo 622*, Herb. Jard. Bot. Rio de Janeiro 55352 (fr.) Dec. 11, 1944 (RB).

24. **Sloanea guapilensis** Standl., Journ. Wash. Acad. Sci. **15:** 478. 1925.
S. Schippii Standl., Carnegie Instit. Wash. Publ. **461:** 70. 1935.

Tree to 13 m. tall, trunk to 23 cm. in diameter. Branchlets with light-brown finely striate bark. Twigs moderately slender, striate, angular, puberulent to pubescent. Leaves alternate, spaced along twigs; stipules 3–4 mm. long, linear-lanceolate, sub-acute, pubescent; petioles 1.5–6 cm. long, subterete, canaliculate at the apex above, striate, incrassate at both ends, glabrous to scattered-pubescent, particularly in a line on the upper side; blades 12.5–28 cm. long, 4.5–11.5 cm wide, elliptical to elliptical-obovate, membranaceous to chartaceous, midrib prominent, usually minutely puberulent above, midrib and secondary veins prominent, glabrous to scattered-hirsute, often dark in color beneath, base subacute to abruptly obtuse to rounded, apex acuminate-obtuse, occasionally mucronulate, margins undulate to repand-dentate to obtuse-dentate, particularly toward the apex. Inflorescences 2.5–3.5 cm. long, peduncles, pedicels and bracts puberulent, peduncles 1.5–2.5 cm. long, pedicels 0.5–2 cm. long, bracts 1–2 mm. long, deltoid to lanceolate, obtuse to subacute; flowers yellow and red, 6–7 mm. long, 6–7 mm. in diameter, sepals 5–7, 1.5–2.5 mm. long, 0.5–1 mm. wide at the base (somewhat larger in fruit), deltoid to lanceolate, subacute, puberulent on both surfaces; stamens 3–4 mm. long, filaments 2.5–3.5 mm. long, somewhat widened upward, anthers usually 0.5 mm. long, oval, puberulent, connective prolonged into a glabrous knob or short, obtuse, stout awn; pistil 5–6 mm. long, ovary 1 mm. long, 1 mm. in diameter, globose, 4-loculed, densely pubescent, gradually giving rise to the style 4–5 mm. long, briefly 4-parted at the apex, pubescent almost to the apex, straight or contorted. Capsule (immature) 1.5 cm. long, 1.4 cm. in diameter, globose, 4–5-valved; valves 1.5–2 mm. thick, surface densely puberulent, densely covered with partly-curved, flexible, reddish spines; spines to 1.8 cm. long, tapering to the acute apex, puberulent. Capsule 1–2-seeded; seed (immature) about 1 cm. long, almost covered with a 3-lobed aril which is firmly attached to the chalazal ¼–⅓ of the seed.

Sloanea guapilensis Standl. is readily distinguished from *S. Tuerckheimii* by the linear-lanceolate stipules, puberulent style

and globose capsules. *S. Schippii* is clearly a synonym of *S. guapilensis*, the specimens intergrading completely.

S. guapilensis has been collected only from British Honduras to Costa Rica in Central America at elevations up to 670 m. (see Map 7).

BRITISH HONDURAS: Rio Grande River, *Schipp 1163* (Type-collection, *S. Schippii*) (fl.) Apr. 21, 1933 (A, F, GH, MO, NY, S). GUATEMALA: IZABAL: along Río Tameja, *Steycrmark 41817* (st.) Dec. 24, 1941 (F, US). COSTA RICA: SAN JOSÉ: Vicinity of El General, *Skutch 4326* (fr.) June, 1939 (A, F, MO, NY, US, S); LIMÓN: Vicinity of Guapiles, *Standley 37352* (Type-collection) (fr.). (US).

25. **Sloanea Tuerckheimii** Donn. Sm., Bot. Gaz. **57:** 416. 1914.
S. macrophylla Benth. ex Turcz., Bull. Soc. Nat. Moscow **31** pt. 1: 224. 1858. In part.
S. usurpatrix Sprague and Riley, Kew Bull. **1924:** 20.
S. eriostemon Sprague and Riley, Kew Bull. **1924:** 19.

Tree to 25 m. high, 3 dm. in diameter; bark grayish. Twigs very stout, glabrate to puberulent to lanate-pubescent. Leaves alternate, spaced along twigs; stipules 6–8 mm. long, 2 mm. wide at the base, lanceolate, densely pubescent; petioles 2–13 cm. long, terete, striate, incrassate at both ends, glabrate to puberulent; blade 11.5–39.5 cm. long, 6.5–18.5 cm. wide, elliptical to oval, coriaceous, midrib and secondary veins somewhat impressed, glabrate to puberulent above, prominent, glabrate to puberulent to pubescent beneath, base obtuse to rounded, apex rounded to short-acuminate-subacute to acuminate-acute, margin irregularly undulate to sinuate-dentate. Inflorescences 5–8 cm. long, peduncles, pedicels and bracts puberulent to pubescent, peduncles 4.5–6.5 cm. long, angled-striate, pedicels 5–16 mm. long, bracts 2–4 mm. long, 0.75–1.5 mm. wide at the base, deltoid to lanceolate, obtuse to subacute; flowers white, cream or yellow, fragrant, 6–8 mm. long, 8–10 mm. in diameter, sepals 5–8, 2–4 mm. long, 0.75–2 mm. wide at the base, ovate to lanceolate, obtuse to acute, pubescent without, puberulent within; stamens 3 4 mm. long, filaments 2–3 mm. long, pubescent, puberulent or glabrate, anthers 1–1.25 mm. long, ellipsoid to oval, opening by a line from ⅓ to their entire length, connective often broad between the anther-sacs on the abaxial side, prolonged into a knob or short stout glabrous awn; pistil 6–9 mm. long, ovary 2–2.5 mm. long, 1.5 mm. in diameter, ovoid, 4-angled, 4-loculed, velutinous, style 6–7 mm. long, briefly 4-parted at the apex, pubescent at the base, glabrous above, occasionally somewhat contorted. Capsule 2.2–2.8 cm. long, to 1.5 cm. in diameter, ellipsoidal, 4-valved; valves 2–3 mm. thick, densely puberulent on the surface, moderately densely covered with semi-flexible somewhat curved spines; spines to 1.8 cm. long, scarcely tapered from the base to the acute apex, antrorsely pubescent. Capsule red within, single-seeded; seed to 14 mm. long, 5 mm. in diameter, ellipsoidal, almost entirely covered with a 4-lobed aril which is firmly attached along the chalazal ½ of the raphe and at the chalazal end of the seed.

Sloanea Tuerckheimii Donn. Sm. is a distinctive species related to *S. pubescens* Benth. It is distinct in its short-awned stamens

and moderately spined fruit. Despite the disjunct distribution, there can be no doubt that the Central American and the South American material are conspecific.

The inclusion of *Schomburgk 1044* with *S. macrophylla* by Turczaninow is rather surprising considering the differences between these two species. The same collection has been included by Sprague and Riley in their citations under the description of *S. usurpatrix* (whose type is *Schomburgk 1021;* the same number is also the type-collection of *S. brevipes* Benth.). The former collection is without doubt referable only to the present species. The type-sheet of *S. usurpatrix* (*Schomburgk 1021* at Kew) is noted by Bentham to be the same as 1044 in Herb. Hooker, and it agrees with all of the material I have seen of 1044 from other herbaria (see discussion under *S. brevipes*). While the filaments of the stamens in the South American collections are glabrate, and the pubescence of the ovary is shorter, I find no clear differences between collections from the two areas and must treat them all as *S. Tuerckheimii* Donn. Sm. The amount of variation in this species is well within the range of variation seen in other species of *Sloanea*. The type-collection of *S. eriostemon* agrees in detail with the type-collection of *S. Tuerckheimii*.

In British Honduras this species is known as "wild ake," "wild nata" or "wild ata wood," while in Mexico "palo colorado" is the common name.

Found from Mexico to Guatemala in Central America, *S. Tuerckheimii* has also been collected in Colombia, the Guianas, and Brazil (see Map 4).

MEXICO: OAXACA: Distrito Choapam, Yaveo, trail to Río Yaves to the west, *Mexia 9291* (fl.) Apr. 11, 1938 (F, GH, MO, NY, US, S). BRITISH HONDURAS: Stann creek district: Middlesex, *Gentle 2786* (fl.) May 5, 1939 (A, F, NY, US); *Schipp 323* (fl.) Oct. 2, 1929 (A, F, GH, MO, NY, US, S); El Cayo District, Mountain Pine Ridge, San Augustin, *Lundell 6824* (fr.) July, Aug., 1936 (GH, MO, NY, S, US); Rio Grande River, *Schipp S-651* (fl.) May 8, 1934 (A, F, GH, MO, NY); Forest near Manatee Lagoon, *M. E. Peck 400* (Type-collection, *S. eriostemon*) (fl.) May, 1913 (A, US, S). GUATEMALA: ALTA VERAPAZ: Cubilquitz, *von Tuerckheim 4157* (Type-collection) (fl.) May, 1913 (A, US, S). BRITISH GUIANA: Wabuwak, Kanaku Mts., Forest Dept. field WB-343, record 5763 (fl.) Oct. 1948 (NY, US). DUTCH GUIANA: Expeditie naar het Wilhelminagebergte 282, Herb. 7101 (fr.) Mar. 23, 1926 (US). COLOMBIA: CAQUETÁ: Florencia, orillas Río Hacha, *Uribe P. 681* (fr.) Dec., 1930 (US); CHOCÓ: Coredó, *Romero C. 479* (fr.) Oct. 12, 1946 (US). BRAZIL: PARÁ: Tapajos, BÔA Vista, *Capucho 562* (fr.) Mar. 16, 1933 (BI, F); AMAZONAS: Rio Negro (?); *Rob. Schomburgk 1044* (fl.) Mar. 23, 1926 (F (photo. and fragments)); *Rob. Schomburgk 1021* (Type-collection, *S. usurpatrix* (fl.) (K).

Section 2. Sloanea nom. nov.

Arbores (raro frutices). Stipulae cum 3 vel 4 foliis novissimis, saepe conspectae, lineari-lanceolatae vel foliaceae. Inflorescentia axillaris, racemosa (in *S. zuliaense*, pedicelli cymosi) plerumque aperta. Sepala 4 vel 11, plerumque inaequalia (cyathiformia et lobata in *S. grandiflora*, patella lobata in *S. zuliaense*). Stamina saepe cum antheris et filamentis aequalibus vel filamenta quam antherae longiora (stamina *S. zuliaensis* dense et globose aggregata). Capsula minime 2.5 cm. longa, plerumque 3 cm. longa vel longiora, cum spinis longis rigidis vel flexilibus (si flexilibus, plerumque fortiter falcatis). Throughout the Amazon basin and northward; with section *Brevispicae*, making up the majority of the species of Central America and the West Indies. Type: *S. dentata* L.

Key to Section 2. Sloanea

A. Stipules 4 mm. wide or wider.
B. Stipules entire to sparsely dentate.
C. Stipules lanceolate, flat; capsule to 4 cm. long, spines to 4.3 cm. long, subrigid, glabrate to scarcely puberulent..34. *S. lanceolata.*
C. Stipules deltoid-lanceolate, navicular; capsule to 3.5 cm. long; spines to 2.5 cm. long, scarcely pulverulent.35. *S. macrophylla.*
B. Stipules undulate, repand-dentate or dentate.
D. Inflorescences about twice as long as the leaf-petioles; capsule to 2.5 cm. long; spines to 2.5 cm. long, scarcely minutely puberulent.....36. *S. zuliaensis.*
D. Inflorescences about equalling the leaf-petioles.
E. Filaments tapered upward to the anthers; ovary angled; capsule to 4.5 cm. long; spines to 3.5 cm. long, puberulent.....29. *S. medusula.*
E. Filaments of about equal diameter throughout; ovary not angled.
F. Calyx of 7–9 free sepals; filaments striate; awn ⅓–½ the length of the anther; capsule (immature) globose, densely covered with curved spines.....30. *S. fragrans.*
F. Calyx cyathiform, 5–9 lobed; filaments angled or laterally flattened, not striate; awn short, triangular; capsule to 5 cm. long; spines curled, pubescent 31. *S. grandiflora.*

A. Stipules less than 4 mm. wide.
G. Inflorescences about twice as long as the leaf petioles; ovary sub-globose; capsule unknown .....33. *S. pubiflora.*
G. Inflorescences about as long as the petioles or shorter; ovary ovoid (except 28. *S. mexicana*).
H. Inflorescences shorter than the petioles; stamens exserted from the calyx; awn about equalling the length of the anther; ovary smoothly ovoid; capsule to 4 cm. long; spines to 3.5 cm. long, slightly curved, glabrate to minutely puberulent.....32. *S. multiflora.*
H. Inflorescences about equalling the petioles.
I. Awn about equalling the length of the anther; ovary ovoid, 4-angled; capsule to 7 cm. long; spines stout, curved, minutely puberulent to glabrous.....27. *S. dentata.*

I. Awn either much shorter or longer than the anther
J. Awn ⅕ to ⅓ the length of the anther; ovary ridged; capsule unknown . . . . . 28. *S. mexicana.*
J. Awn longer than the anther; ovary smooth, neither ridged nor angled; "capsule subglobose, 2 cm. thick; setae to 4.5 cm. long" *fide* Pittier . . . . 26. *S. megaphylla.*

26. **Sloanea megaphylla** Pittier, Fedde Rep. Spec. Nov. **13:** 312. 1914.

Tree to 25 m. high, trunk about 40 cm. in diameter with flat buttresses. Branchlets robust, bark gray-brown, rough, somewhat striate. Leaves alternate; stipules to 7 mm. long, obtuse, pubescent; petioles 9–11 cm. long, robust terete, striate, incrassate at both ends, glabrous; blades 43–62 cm. wide, elliptical-obovate, heavy-rugose-coriaceous, midrib, secondary and tertiary veins impressed, glabrous above, prominent, puberulent to scattered-pubescent beneath, secondary veins 12–18, arcuate-ascending; base cordate, apex obtuse, margin irregularly undulate. Inflorescence 5–13 cm. long, peduncles, pedicels and bracts puberulent; peduncles 2.5–10.5 cm. long, angled, striate; pedicels 2.5–4.5 cm. long, angled, striate, enlarged upward to the calyx; bracts 8–14 mm. long, 0.5–2 mm. wide at the base, lanceolate, sparsely dentate, obtuse; flowers 1.0–1.5 cm. long, 1.2–1.5 cm. in diameter, sepals 7–9, 7–9 mm. long, 1–1.5 mm. wide at the base, striate, densely puberulent without and within; stamens 10–11 mm. long, filaments 6–7 mm. long, pubescent, anthers 1–1.5 mm. long, ovoid, pubescent, connective prolonged into an awn 1.5–2.5 mm. long, glabrous; pistil 14–16 mm. long, ovary to 3 mm. long, 2.5–3 mm. in diameter, ovoid, 4–5-loculed, densely tawny-tomentose, style 11–13 mm. long, 4-or 5-angled at the base, 4–5-parted at the apex, pubescent ⅘ of its length, glabrous on the apical ⅕. Capsule not seen. "Fruit sub-globose with dense aculeate rufous setae." "Capsule about 2 cm. thick, setae 4.5 cm. long, seed 1 cm. long." Pittier—loc. cit.

Sloanea megaphylla is a distinct entity with its very large leaves, and inflorescences. It is included in Section *Sloanea* because of its general characteristics. Only one collection has been seen and this is insufficient to show the persistence of the stipules. The general habit, the dentate bracts, and the floral characters indicate the affinities of this species with *S. dentata* of the West Indies.

S. megaphylla is endemic to Panama (see Map 4).

PANAMA: COLÓN: Along Río Fató, *Pittier 3920* (fl.) July, 1911 (F, US).

27. **Sloanea dentata** Linnaeus, Sp. Pl. 512. 1753.

†*Sloanea amplis castaneae foliis, fructu echinato.* Plum., Nov. Pl. Amer. Gen. 49, tab. 15. 1703 and ed. Burm. 240, tab. 244, fig. 1. 1755.
Castanea Sloanea Mill., Gard. Dict. ed 8. 1768.
S. Plumerii Aubl., Pl. Guian. **1:** 536. 1775. At least as to name.
S. Plumieri G. Don, Gen. Syst. **1:** 555. 1831.

Tree to 25 m. high. Branches with gray, striate bark. Twigs robust, densely short-pubescent becoming glabrate, striate. Leaves alternate; stipules 10–20 mm. long, linear to lanceolate, obtuse, more or less serrate-mar-

gined; petioles 2.5–8 cm. long, terete, incrassate at both ends, often striate, minutely puberulent to glabrate; blade 11–80 cm. long, 9.5–40 cm. wide, oval to obovate, coriaceous, midrib and secondary veins impressed, short-fuscous-puberulent above, prominent, scattered-puberulent to glabrate below, secondary veins 10–14, arcuate-ascending; base rounded, apex emarginate to subacuminate-obtuse, margin entire to irregularly undulate to sinuate-dentate toward the apex. Inflorescences 5–8 cm. long, peduncles, pedicels and bracts puberulent, peduncles 3.5–7 cm. long, pedicels 0.8–1.5 cm. long, bracts 7–10 mm. long, lanceolate-naviculate, obtuse, serrate-margined; flowers cream, 8–10 mm. long, 9–11 mm. in diameter, sepals 5–9, 5–6 mm. long, 0.75–2.5 mm. wide at the base, elliptical-ovate to lanceolate, obtuse, rarely bidentate at the apex, sparsely puberulent, at times striate without, sparsely minutely puberulent within; stamens 5–6 mm. long, filaments 3–4 mm. long, more or less flattened laterally and 4-angled, puberulent, anthers about 1 mm. long, lenticular, pubescent, connective prolonged into an awn 0.5–1 mm. long, puberulent; pistil to 10 mm. long, ovary 2 mm. long, 2 mm. in diameter, ovoid, 4-angled, 4-loculed, densely velutinous, style to 8 mm. long, tapered upward, velutinous over the basal ⅔, glabrous above, apex briefly 4-parted, at times contorted toward the apex. Capsule 5–7 cm. long, 4–6 cm. in diameter, subglobose, 4-loculed, 1-seeded, 4-valved; valves woody, 9–15 mm. thick, densely covered with spines; spines semi-rigid, stout, curved, tapered upward from the base, minutely puberulent to glabrous. Seed to 15 mm. long, 6.5 mm. in diameter, ellipsoidal, covered entirely by a 3-lobed aril which is firmly attached to the chalazal ¼ of the seed. Margin of the aril lobes undulate.

Sloanea dentata L. is the original species of the genus, being based on a Plumier plate and description. This has been a confused entity, the name having been applied to various trees in the Antilles and South America. There is no doubt that the plant illustrated by Plumier is the Antillean species; the details of the flowers and fruit are unmistakable, although the leaf is shown with a more cordate base than I have generally seen in the specimens.

In addition to misapplication of Linnaeus' name to the large-flowered South American species *S. grandiflora*, several other names have been applied to *S. dentata* itself. Miller, perhaps misled by "castaneae foliis" and based on fruits which he saw, renamed the species *Castanea Sloanea*. It is difficult to determine whether Miller's fruits were those of *Sloanea* or not, as he seemed to think that his specimens originated on the mainland of North America far outside of the range of *Sloanea*. Aublet proposed the name *S. Plumerii*, citing the Plumier plate in synonymy, but stating that he had seen several trees at Aroura, French Guiana. Again, I can not accurately determine whether the description applies to the West Indian species or not, but it seems to fit this entity more closely than it fits the South American species. George Don took up the Aublet name (as *S. Plumieri*) which he

applied only to the Antillean species, reserving *S. dentata* for the species from South America.

I have already discussed the history of the Swartz name *S. Massoni* which was long confused with *S. dentata*.

S. dentata is a frequent tree in the rainforests from Montserrat to Martinique. The large flowers and, particularly, the large fruits are very distinctive. Apparently the most closely related species is *S. megaphylla* of Panama. The tree is locally known as "burwood" in the English islands or "chataignier grand feuille" in the French islands.

Hahn 202 is a mixed collection of which the Gray Herbarium sheet is *S. dentata* and the Stockholm sheet is *S. Massoni*.

S. dentata occurs on all the islands from St. Kitts to Martinique which have sufficient area to support a moist forest vegetation (see Map 4).

St. Kitts: Wingfield Estate; *M. Smith s. n.* (fr.) May 1952 (GH). Montserrat: Centre Hills, *Beard 408* (fr.) Nov. 7, 1944 (A, MO). Guadeloupe: Bois de Bains-Jaunes au Gommier au Matouba de la Pointe Noire, *Duss 3268* (fl. & fr. immature) July 18, 1892 (NY). Dominica: Castle Bruce, Midward, *G. A. Ramage s. n.* (fr.) Feb. 5, 1889 (GH); Carib Trail between Riversdale and Deux Branches, *Howard 11768* (fl. & fr.) May 27–June 7, 1950 (GH). Martinique: Morne du Krou Valliant, *Belanger 679* (fl.) June, 1854 (G); *Hahn s. n.* (fl. & fr.) 1868–69 (G); *Hahn 202* (fr.) 1871 (GH).

28. **Sloanea mexicana** Standley, Contrib. U. S. Nat. Herb. **23:** 734. 1923.

Tree 15–20 m. high. Twigs sulcate, yellowish-puberulent. Leaves alternate; stipules 8–10 mm. long, to 2 mm. wide, elliptical, somewhat naviculate, apex acute, margin irregular, more or less dentate, yellowish-puberulent; petioles 8.5–9 cm. long, terete, scarcely striate, yellowish puberulent; blade 33.5–34.5 cm. long, 15.5–17 cm. wide, elliptical, firmly coriaceous, midrib scarcely impressed, puberulent, secondary veins somewhat puberulent above, lower surface not seen, base rounded to scarcely cordate, apex acute, margin irregularly undulate. Inflorescences 6.5–10.5 cm. long; peduncles, pedicels and bracts yellowish-puberulent; peduncles 4.5–8.5 cm. long, angled, striate; pedicels 1–2.5 cm. long, angled, striate; bracts 4–7 mm. long, 1.5–3 mm. wide, ovate, naviculate, striate, acute, serrate-margined, or, at times, sub-lobed; flowers yellow (*fide* Langlassé) to 10 mm. long, 12 mm. in diameter, sepals 5–8, 5–7 mm. long, 1.5–2.5 mm. wide at the base, striate, elliptical to subobovate, acuminate, obtuse, puberulent within and without; stamens 4–6 mm. long, filaments 3–4 mm. long, minutely puberulent, tapered upward to the anther-sacs, anthers 1–1.5 cm. long, ellipsoidal, minutely puberulent, connective continued into a minutely puberulent awn ⅕ to ⅓ the length of the anther; pistil to 8 mm. long, ovary 2 mm. long, 2 mm. in diameter, subglobose, densely velutinous, 4–5-loculed, with a light-colored ridge over each locule on the outside, style to 5 mm. long, puberulent on the basal ½, glabrous above, sometimes slightly contorted. Fruit not seen.

Although *Sloanea mexicana* Standl. is known from only one collection, it is an easily distinguished species. That it is closely related to *S. dentata* is shown by the calyx, the dentate bracts and the puberulent awns of the anthers.

S. mexicana has been collected only in Mexico (see Map 4).

MEXICO: MICHOACÁN & GUERRERO: La Siberia, *Langlassé 980* (Type-collection) (fl.) May 30, 1899 (G, GH, US).

29. **Sloanea medusula** Schumann and Pittier, Fedde Rep. Spec. Nov. **13:** 312. 1914.

S. palmana Standley, Field Mus. Pub. Bot. **18:** 662. 1937.
S. hyptoides Standley, Field Mus. Pub. Bot. **18:** 1559. 1938.
S. ampla Johnston, Journ. Arn. Arb. **19:** 124. 1938.
S. platyphylla Standley in Woodson and Schery, Ann. Mo. Bot. Gard. **27:** 318. 1940.

Tree to about 40 m. (*fide* Skutch); trunk with small plank buttresses; or shrub (*fide* Steyermark). Twigs slender to robust, more or less striate to angled-sulcate, puberulent to lanate-pubescent. Leaves alternate; stipules 1.5–3.5 cm. long, 4–12 mm. wide, elliptical-obovate, scarcely naviculate, base rounded, apex obtuse to acuminate-acute, margin undulate to irregular, adaxial surface glabrate to puberulent, abaxial surface with glabrate to puberulent to densely pubescent midrib, pubescence otherwise sparse; petioles 2–15 cm. long, sub-terete, striate, glabrate to pubescent; blade 8.5–57 cm. long, 3.5–31 cm. wide, obovate to elliptical-obovate, chartaceous to coriaceous, midrib and secondary veins sub-prominent, puberulent to pubescent above, prominent, glabrous to puberulent to pubescent beneath, secondary veins 8–14, ascending, scarcely arcuate to arcuate, base obtuse to rounded, apex obtuse to acuminate-obtuse to acute. Inflorescences 4–18 cm. long, peduncles and pedicels puberulent to densely pubescent, peduncles 3.5–15.5 cm. long, often angled-striate, pedicels 0.5–4 cm. long, angled-striate, bracts 0.5–1.5 cm. long, 0.2–1.3 cm. wide, lanceolate to obovate, sub-naviculate, apex acute to obtuse, margin irregularly undulate to sparsely dentate, occasionally 3-lobed, pubescent overall, or, like the stipules, densely pubescent in the center, otherwise sparsely so; flowers 0.7–1.8 cm. long, 1–2 cm. in diameter, sepals 6–11, 3–10 mm. long, 1–5 mm. wide at the base, striate, deltoid to lanceolate, apex obtuse to acute, occasionally bidentate, sparsely to densely pubescent without and within; stamens 4–6 mm. long, filaments 2–3 mm. long, striate, enlarged upward to the anther-sacs, puberulent, anthers 1–2 mm. long, elliptical, short-puberulent, connective prolonged into a short sparsely puberulent awn; pistil 6–13 mm. long, ovary about 2 mm. long, 2–3 mm. in diameter, ovoid, 4–5-loculed, 4–5-rounded-angled, densely velutinous, style 4–11 mm. long, the basal ⅓ to ⅔ velutinous, apex glabrous, scarcely or not parted, contorted or straight. Capsule reddish, to 4.5 cm. long, sub-globose (?), 4-valved, single-seeded; valves to 7 mm. thick, densely covered with rigid spines; spines to 3.5 cm. long, tapering gradually to the apex, antrorsely puberulent. Seed ellipsoidal, almost covered by a reddish aril.

Sloanea medusula Schum. and Pitt. is a distinct species related to the succeeding species which have similar large stipules, many-parted calyces and relatively large fruit.

The great variation in flower-size seen in *S. medusula* is unusual in the American species of *Sloanea*. A large amount of foliar variation is to be expected in the genus, particularly in those species growing in areas which have been deforested and have become overgrown in part with second-growth forest. This may also affect the habit of the plant, as is shown by *Steyermark 33419* (specimen from a 20 ft. shrub). Another developmental abnormality is that present in *Smith 4121* where the peduncle of the inflorescence continued to elongate, and the large bracts became wholly or partly converted to small foliage-leaves. Each twig in this collection, then, represents only a single abnormal inflorescence. Only when it grows in the undisturbed rainforest does *S. medusula* attain normal size and aspect and become one of the dominant trees.

S. medusula is found from Guatemala southward in Central America and extending into the Pacific coast area of Colombia (see Map 4).

GUATEMALA: SUCHITEPÉQUE: Volcán Zunil: *Steyermark 35204* (fl.) Jan. 31, 1940 (F); *Skutch 968* (Type-collection, *S. ampla*) (fr.) Aug. 7, 1934 (A, F, US); QUETZALTENANGO: along road between Finca Pirineos and Patzulín, *Standley 86684* (fr.) Feb. 9, 1941 (F). COSTA RICA: SAN JOSÉ: Santa María de Dota *Standley 42830* (fr.) Dec. 14–26, 1925 (US); ALAJUELA: Zarcero, Baja Vista Road, *A. Smith 4121* (Type-collection, *S. hyptoides*) (fl.) Apr. 14, 1937 (F); Río Hondo pres Madre de Dios, *Pittier 16141* (Type-collection) (fl.) July, 1901 (US); La Palma de San Ramón, *Brenes 6786* (Type-collection, *S. palmana*) (fl.) Mar. 30, 1929 (F). PANAMA: COCLÉ: *Allen 1810* (Type-collection, *S. platyphylla*) (fl.) May 21, 1939 (F, MO, NY, US). COLOMBIA: EL VALLE: Costa del Pacifico, Río Naya, Puerto Merizalde, *Cuatrecasas 14098* (fl.) Feb. 23, 1943 (F).

30. **Sloanea fragrans** Rusby, Mem. N. Y. Bot. Gard. **7**: 294. 1927.

Large tree. Twigs robust, brown, striate, puberulent. Leaves alternate, stipules (in the type-collection foliaceous) about 2.5–13 cm. long, 1.3–6 cm. wide, obovate, obtuse, irregularly dentate, glabrate to very minutely puberulent particularly along the midrib on the abaxial surface; petiole 5–20 cm. long, terete, striate, scarcely minutely puberulent, incrassate at both ends with a concave area on the under side of the swelling at the base of the blade; blade 45–65 cm. long (apex broken on the larger specimen), 21–29.5 cm. wide (margin broken on the larger specimen), obovate, hard-coriaceous, midrib and secondary veins prominent, glabrate to very minutely puberulent above and beneath, base acute, apex obtuse, margin irregularly undulate. Inflorescences 13–27 cm. long, peduncles, pedicels and bracts minutely puberulent, peduncles 10.5–24 cm. long, angled-striate, pedicels 0.7–2.5 cm. long, angled-striate, bracts 4–10 mm. long, 2–4 mm. wide, ovate, naviculate, obtuse, margin irregular to few-dentate; flowers 1–1.5 cm. long, 1.3–1.8 cm. in diameter, sepals 7–9, 4–6 mm. long, 1–3 mm. wide at the base, ovate to lanceolate, obtuse, entire-margined, puberulent to silky-pubescent within and without; stamens 4–8 mm. long, filaments 1.5–2 mm. long, at times striate, puberulent, anthers 2–3 mm.

long, lanceolate, puberulent, connective prolonged into a flattened awn to 1 mm. long, with thin margins, the awns before anthesis closely imbricate, forming a sub-globose mass; pistil 7–13 mm. long, ovary to 3 mm. long, and 3 mm. in diameter, 4-loculed, densely long-pubescent, style 5–10 mm. long, pubescent its entire length or only on the basal ½, not parted at the apex. Capsule (very immature) globose, densely covered with curved spines.

Sloanea fragrans Rusby is related to *S. medusula* as is shown by the large stipules, the 7–9-parted calyx, and the similar pistil, but it differs markedly in the awns specialized to serve as a covering for the essential organs prior to anthesis, and in the capsule with much curved spines. This species represented by a fertile specimen with apparently normal foliage is the largest-leaved *Sloanea*. The adventitious foliage of the Antillean species *S. dentata* and *S. Massoni* is much larger, but flowering or fruiting specimens always bear much smaller leaves than *S. fragrans*. This species seems to be local in distribution and probably also with a crown high in the flood-forest canopy so that it is largely inaccessible to the collector. Its present known distribution in Colombia, Peru and Bolivia indicates a range extending throughout the western Amazonian watershed (see Map 4).

COLOMBIA: PUTOMAYO: Río Putomayo en las margenes del afluente izquierda La Concepción, *Cuatrecasas 10832* (fl. & fr. immature) Nov. 27, 1940 (COL, F, US). PERU: Stromgebiet des Marañon, Santiago-Mündungam Pongo de Manseriche, *G. Tessman 4609* (fl.) 1924 (NY, S). BOLIVIA: Bopi River Valley, *Rusby 742* (Type-collection) (fl.) Sept. 8, 1921 (GH, NY).

31. **Sloanea grandiflora** J. E. Smith in Rees, Cycloped. **33.** 1819.
   ✳*S. dentata* of authors not L., as applied to South American plants.
   S. amplifrons Johnston, Contrib. Gray Herb. n. s. **75:** 29. 1925.
   S. Linderi Johnst. ex Kribs, Trop. Woods no. **13:** 16. 1928. Nomen nudum.

Tree to 20 m. tall. Twigs robust, scarcely striate, powdery-brown-puberulent. Leaves alternate; stipules 14–24 mm. long, 6–14 mm. wide, navicular, ovate, apex at times attenuate, acute, margin finely dentate, glabrate to powdery-brown-puberulent; petioles 7–18 cm. long, terete, striate, generally powdery-puberulent, incrassate at both ends, the swelling at the base of the leaf-blade with a concave area on the under side: blade 21–43.5 cm. long, 15–25.5 cm. wide, elliptic to elliptic-obovate to obovate, chartaceous to coriaceous, midrib and secondary veins prominent, glabrous to pulverulent above and beneath, secondary veins 13–15, arcuate-ascending, base rounded to cordate, apex obtuse, margin irregularly dentate. Inflorescences 5.5–12 cm. long, peduncles, pedicels and bracts puberulent, peduncles 4–9 cm. long, striate, pedicels 1.5 -3.4 cm. long, angular-striate, bracts 3–12 mm. long, 2–5 mm. wide, navicular, lanceolate to ovate, acute, margin dentate; flowers with pink pedicels and sepals, yellow stamens, 10–13 mm. long, 10–15 mm. in diameter, calyx cyathiform, 5–9-lobed, lobes obtuse, puberulent without and within; stamens 7–9 mm. long, filaments 2–4 mm. long, angled or flattened laterally, puberu-

lent, anthers 3–4 mm. long, linear-lanceolate, puberulent, connective very wide between the anther-sacs on the abaxial side, continued above the anther-sacs into a glabrous, triangular, acute or obtuse awn, often laterally flattened when young; pistil 9–14 mm. long, ovary to 4 mm. long, 2.5 mm. in diameter, ovoid, 4–6-loculed, densely pubescent, style gradually arising from the apex of the ovary, 6–9 mm. long, pubescent or puberulent on the basal ½ to ⅔, glabrous above, not parted at the apex. Capsule 4.5–5 cm. long, about 3 cm. in diameter, ellipsoidal, 4–6-valved; valves 2.5–3 mm. thick, densely covered with stramineous flexible curled spines; spines tapered from the base, antrorsely pubescent. Seed usually one per capsule, to 2.7 cm. long, 1 cm. in diameter, ellipsoidal; aril covering the seed usually 4-lobed, the lobes irregular, shallow; aril firmly attached to the chalazal ¼ to ⅓ of the seed.

Sloanea grandiflora Sm. is closely related to *S. fragrans* as is shown by the stipules, the stamens and the capsules which are similar in both species. The chief differences are the cyathiform calyx and the finely dentate margin of the stipules in the former species, the deeply cut calyx and the irregularly serrate margins of the stipules in the latter species.

This species has been confused with *S. dentata* L. for many years, having been treated as the latter species in most of the floras of tropical South America. The name *S. grandiflora*, apparently, has never been applied to the taxon, although Smith clearly pointed out the characters which differentiated it from *S. dentata*. Smith's name has generally been cited in the synonymy of *S. dentata*. Johnston recognized the South American entity as distinct from the Antillean tree and published it in 1925 as *S. amplifrons*, unaware of the previous name applied by Smith. Finally in 1928, in connection with the study of tropical wood-anatomy, this species was given the invalid name *S. Linderi* Johnston ex Kribs, being published only with a description of the wood anatomy.

Sloanea grandiflora is the only species of *Sloanea* proven to be a myrmecophyte. The large stipules of this species are inhabited by ants. There seems to be no real specialization for this relationship. It is probably only by chance that the large, naviculate stipules are ever employed as domatia.

S. grandiflora is largely restricted to the northeast coastal area of South America between the mouth of the Orinoco River and the mouth of the Amazon River (see Map 9).

French Guiana: Maroní (River), *Mélinon s. n.* (fr.) 1877 (F); In marginibus fluvii Kourou, Gabrielle, *L. C. Richard s. n.* (fr.) (P). Dutch Guiana: Brownsberg, tree 1259, *C. Zeandam 6768* (fr.) Jan. 21, 1925 (L); Kabelstation, Boschwezen (fl.) Aug. 1914 (BI). British Guiana: *Schomburgk 768* (fl. & fr.) 1841 (F, GH); Koeai Creek, *Linder 158* (Type-collection, *S. amplifrons*) (fr.)

Jan., 1924 (GH, NY); Pomeroon River, *Jenman 1620* (fl. & fr.) Dec., 1882 (NY); Mazaruni Station, Karau Creek, *F. G. Tutin 137* (fl.) May 25, 1933 (US); Kartabo Region, Cayuni River, *Bailey 37* (fr.) July 30, 1920 (GH); Essequibo River, Moraballi Creek, near Bartica, *Sandwith 250* (fl.) Sept. 13, 1929 (NY). VENEZUELA: MONAGAS: entre Caripito y Churiquere, *Tamayo 3515* (fr.) Mar. 9, 1948 (VEN); BOLÍVAR: En la serranía de Guayapo, Bajo Caura, *Llewelyn Williams 11834* (fr.) Apr. 16, 1939 (F, US, VEN). BRAZIL: PARÁ: Belém: I. A. N., *Pires 3127* (fl.) Feb. 6, 1951 (GH); Rio Canaticú, Ilha de Marajo, *Pires 1215* (fr.) Aug. 20, 1948 (GH, VEN); TERR. DO AMAPÁ: Beira do Rio Oiapoque, *Fróes 25747* (fr.) Jan. 31, 1950 (BI).

32. **Sloanea multiflora** Karsten, Fl. Columb. **2:** 31, tab. 116. 1862.
S. castanocarpa Triana & Planchon, Ann. Sci. Nat. Ser. IV. **17:** 345. 1862.
S. Onotillo Steyer., Fieldiana: Bot. **28:** 358. 1952.
S. Onotillo var. *major* Steyer., Fieldiana: Bot. **28:** 359. 1952.

Large tree with buttressed trunk (*fide* Cuatrecasas). Twigs brown, somewhat striate, glabrous to scarcely minutely puberulent, when young subsulcate. Leaves alternate; stipules to 6 mm. long, 1.5–2 mm. wide, naviculate, lanceolate, margin finely subdentate, obtuse; petioles 2.2–18 cm. long, terete, striate, incrassate at both ends, top swelling with slight concave area on the under side; blade 12.5–44.5 cm. long, 6.5–35 cm. wide, ovate to oval to elliptical or elliptical-obovate, firmly chartaceous to coriaceous, midrib and secondary veins distinct, pulverulent above, prominent, glabrous beneath, secondary veins arcuate-ascending, particularly at the margin where they curve strongly back and almost join the next vein above, base acute to rounded to subcordate, apex very short-acuminate, obtuse to rounded, margin undulate to strongly undulate to repand-dentate. Inflorescences 4.5–8.5 cm. long, much branched; peduncles, pedicels and bracts scattered-puberulent, peduncles 3–7 cm. long, angled-striate, pedicels 0.7–1.5 cm. long, angled-striate, tapered upward to the base of the calyx; flowers 6–7 mm. long, 8–9 mm. in diameter, sepals 6–7, 3–4 mm. long, 1–2 mm. wide at the base, deltoid to lanceolate, subacute, puberulent without, sparsely puberulent within; stamens 5–6 mm. long, filaments 2–2.5 mm. long, obscurely striate, short-pubescent, anthers 1–1.25 mm. long, elliptical, pubescent with conspicuously longer pubescence at the apex, connective prolonged into an awn to 1 mm. long, scattered-short-pubescent, obtuse; pistil to 6 mm. long, ovary to 1.5 mm. long, 1.5 mm. in diameter, ovoid, usually 4-loculed, gradually giving rise to the style: style to 4.5 mm. long, tapered from the base, puberulent on the basal ⅔, glabrous above, 4-parted at the apex. Capsule 3–4 cm. long, 2.5–3 cm. in diameter, subglobose, 1 2-seeded, 4-valved; valves 3–7 mm. thick, woody, densely covered with slightly curved spines; spines to 3.5 cm. long, tapering from the base, abruptly at first, then more gradually, glabrate to minutely puberulent. Seed to 1.5 cm. long, 0.8 cm. in diameter, ellipsoidal, almost completely covered with a fleshy aril; the aril with 3 large lobes and 3 small lobes, the margin of the large lobes irregular, the apex of the small lobes subacute. Aril firmly attached to the chalazal ⅓ of the seed.

Sloanea multiflora is set apart from *S. grandiflora* by its much smaller stipules which do not persist as long, by its deeply cut calyx, long staminal awns and by its nearly straight-spined fruit.

Although Steyermark has set *S. Onotillo* and *S. Onotillo* var. *major* apart from *S. multiflora* by the shorter spines of the capsule, the "narrowed leaf base" and "less repand-sinuate leaf margins," I feel that the specimens which he cites fit well within the range of variation of *S. multiflora*. *S. castanocarpa* is clearly a synonym of *S. multiflora*. The wood of this species is used in Venezuela for house construction and in western Colombia for making "potrillos."

S. multiflora occurs only in the northwestern part of South America in the higher lands of Venezuela and Colombia where it is found at elevations up to 1400 m. (see Map 9).

VENEZUELA: prope Coloniam Tovar, *Fendler 1746* (fr.) 1856–57 (F, G, GH, K); ANZOÁTEQUI: headwaters of Río Maravilla east of Bergantín, *Steyermark 61726* (Type-collection, *S. Onotillo* var. *major*) (fr.) Mar. 23, 1945 (F, NY, VEN); Woods along Río León northeast of Bergantín, *Steyermark 61016* (Type-collection, *S. Onotillo*) (fr.) Feb. 20, 1945 (F, NY, VEN). COLOMBIA: EL VALLE: Río Calima (región del Chocó), Quebrada de La Brea, *Cuatrecasas 21290* (fr.) May 24, 1946 (F); Villavicencio, Llano de San Martin; *Triana 5363* (Type-collection, *S. castanocarpa*) (fl. & fr.) Feb., 1856 (COL, F (fragment & photo.), NY, US); *H. Karsten s. n.* (Type-collection) (fl. & fr.) (F, GH).

33. **Sloanea pubiflora** Planchon and Linden ex Bentham, Journ. Linn. Soc. **5:** suppl. 67. 1861.

Tree (*fide* Bentham). Twigs robust, puberulent, striate on new growth. Leaves alternate; stipules to 7 mm. long, 1.5 mm. wide at the base, lanceolate, naviculate, obtuse, margin entire; petioles to 2 cm. long, striate, minutely puberulent, somewhat incrassate at both ends; blade 13.5–17.5 cm. long, 9–11.5 cm. wide, elliptical to obovate, coriaceous, midrib and secondary veins distinct, pulverulent above, prominent, minutely puberulent beneath, secondary veins arcuate-ascending, generally branched near the margin, base acute, apex rounded, at times emarginate, margin irregularly shallowly undulate. Inflorescences 5–8.5 cm. long, peduncles, pedicels and bracts densely pubescent, peduncles 4.5–7 cm. long, angled-striate, much branched with pedicels crowded at the ends; pedicels 0.5–1 cm. long, angled-striate, bracts 3–8 mm. long, 1.5–3 mm. wide, ovate, naviculate, obtuse, margin entire, occasionally developed into small leaves to 13 mm. long and 9 mm. wide; flowers rose (*fide* Schlim), 5–6 mm. long, 7–9 mm. in diameter, sepals 5–8, 5–6 mm. long, 1–3 mm. wide at the base, lanceolate to ovate, obtuse, entire to scarcely few-dentate, pubescent within and without; stamens 4–6 mm. long, filaments 2–3 mm. long, striate, puberulent, often flattened laterally, anthers 0.5–1 mm. long, ovate, minutely puberulent with a densely puberulent base, connective prolonged into a minutely puberulent awn 0.5–0.75 mm. long; pistil to 6 mm. long, ovary to 2.5 mm. long, 2 mm. in diameter, subglobose, 4–5-loculed, densely pubescent, style arising abruptly; style to 3.5 mm. long, tapered from the base, pubescent on the basal ½, glabrous above, briefly 4–5-parted at the apex. Fruit unknown.

Sloanea pubiflora Pl. & Lind. ex Benth. is closely related to *S. multiflora* Karst. and may prove to be conspecific with it when further Colombian collections become available. The major

differences are in the smaller foliage, the very pubescent inflorescences of *S. pubiflora*, the entire rather than subdentate stipules and the style of *S. pubiflora* which arises abruptly from the ovary rather than gradually. Otherwise, the floral characters are very much alike in the two species.

S. pubiflora is known only from Colombia in the highlands (see Map 9).

COLOMBIA: Río Hacha, Sierra Nevada, *L. Schlim 839* (Type-collection) (fl.) Mar., 1852 (F (fragment & photo.), G); Ocaña, *Schlim 776* (fl.) US (photo.).

34. **Sloanea lanceolata** C. E. Smith, spec. nov.

Arbor ad 30 m. alta. Cortex ramulorum cano-striatus; surculi robusti, striati, pubescentes vel hirsuti. Folia alternata; stipulae ad 2.2–4 cm. longae, 0.4–0.8 cm. latae, lanceolatae, integrae vel paucidentatae, apice acutae vel attenuato-acutae; petioli ad 2–6.5 cm. longi, teretes, basi parce incrassati, puberuli vel hirsuti; lamina 13.5–40.5 cm. longa, 5–15.5 cm. lata, elliptica vel elliptico-obovata, chartacea, nervus primarius et nervi secundarii supra prominentes, glabri vel hirsuti, subtus fortiter prominentes, glabrati vel hirsuti, nervi secundarii 12–19, arcuato-adscendentes; basi subacuta vel obtusa, apice acuta vel attenuato-acuta. Inflorescentia ignota. Capsula ad 4 cm. longa, ad 3.8 cm. lata, sub-globosa, valvae 4, ad 7 mm. crassae, extus dense spinosae; spinae ad 4.3 cm. longae, glabratae vel parce puberulae. Semen 1, ad 2.2 cm. longum et latum, globosum, arillus ignotus.

Sloanea lanceolata is a very distinct species with its large lanceolate stipules having conspicuous venation and its large globose seed. Although this species is inadequately known from these few collections, it is placed in this section on the basis of several characters: the venation is distinct on the upper surface of the lamina as in several species of this group; the venation of the lamina coincides in general aspect with nearby species; nearly comparable stipules are found in this section of the genus; and, finally, the capsule characters place this species definitely with *S. multiflora*, *S. macrophylla* and *S. zuliaensis*.

S. lanceolata occurs in British Guiana and the upper Amazon basin of Brazil (see Map 9).

BRITISH GUIANA: Baibidanni Creek, Demerara River, Forest Dept. field F-363, record 3099 (Type-collection) (fr.) Feb. 21, 1940 (K). BRAZIL: AMAZONAS: Camaná, Rio Javary, *J. W. H. Traill s. n.* (st.) Dec. 4, 1874 (K).

35. **Sloanea macrophylla** Bentham ex Turczaninow, Bull. Soc. Nat. Moscow **31** pt. 1.: 224. 1858.
S. macrophylla Spruce ex Benth., Journ. Linn. Soc. 5: suppl. 67. 1861.
S. caudata Steyerm., Fieldiana Bot. 28: 357. 1952.

Tree to 32 m. tall (*fide* Steyermark), or shrub to 8 m. tall (*fide* Fróes). Twigs slender to robust, brown, scarcely striate to sulcate, glabrate to pulverulent. Leaves alternate; stipules persistent on young twigs, 15–17 mm. long, 4–6 mm. wide at the base, deltoid-lanceolate, naviculate, obtuse, puberulent, margin more or less entire; petioles 6–21.5 cm. long, terete, striate, pulverulent, incrassate at both ends, upper swelling with a concave area on the under side; blade 15–40 cm. long, 11–19 cm. wide, elliptical, midrib and secondary veins distinct, minutely puberulent above, prominent, glabrate to scarcely pulverulent beneath, secondary veins ascending, usually strongly arcuate toward the margin, base rounded, apex attenuate, acute, margin undulate to irregularly dentate. Inflorescences 4.5–8.5 cm. long, peduncles, pedicels and bracts minutely puberulent, peduncles 3–7 cm. long, angled-striate, pedicels 1–2.5 cm. long, angled-striate, tapered upward to the base of the calyx, bracts 4–10 mm. long, 2–4 mm. wide, ovate to lanceolate, naviculate, obtuse, margin few-dentate; flowers with green-tipped salmon sepals, buff-yellow stamens (*fide* Steyermark), 10–13 mm. long, 9–11 mm. in diameter, sepals 5–7, 4–5 mm. long, 1–3 mm. wide at the base, deltoid to lanceolate, obtuse, entire, puberulent within and without; stamens 4–6 mm. long, filaments 0.5–1 mm. long, usually flattened laterally, minutely puberulent, anthers 2–4 mm. long, lanceolate, minutely puberulent, connective prolonged into a glabrous awn 0.3–0.5 mm. long; pistil 8.5–9 mm. long, ovary about 2 mm. long, 2 mm. in diameter, ovoid, 4–5-angled, 4–5-loculed, densely pubescent, gradually giving rise to the tapered style, style 5–7 mm. long, puberulent on the basal ⅓ to ½, glabrous above, straight or somewhat contorted, not parted at the apex. Capsule to 3.5 cm. long, to 2 cm. in diameter, ellipsoidal, usually 4-valved, 1 2-seeded; valves to 4 mm. thick, densely covered with spines; spines to 2.5 cm. long, tapered from the base, straight or slightly curved, scarcely pulverulent. Seed to 1.5 cm. long, 1 cm. in diameter, ovoid, almost completely covered by an aril with one small lobe and three large lobes, the margin of the lobes irregular; aril firmly attached to the chalazal ¼ of the seed.

Sloanea macrophylla Benth. ex Turcz. is easily distinguished from *S. multiflora* and *S. zuliaensis* by the very short, often flattened filaments, and by the generally attenuate apices of the leaf-blades. Although not a constant character, the very long petioles may characterize this species when they are present.

In discussing the relationships of *S. caudata*, Steyermark differentiated his species from *S. macrophylla* by the free stamens. The stamens of *S. multiflora* and other species such as *S. Schomburgkü* are coherent only before anthesis and they become free when the flower is mature. Clearly, *S. caudata* and *S. macrophylla* are synonymous.

S. macrophylla has been collected only in Venezuela and southward in Brazil to the Rio Solimões (see Map 9).

Venezuela: Distrito Federál, Cordillera Avila above Caracas, *Steyermark 55039* (fr.) Dec. 28, 1943 (F); Bolívar: Quebrada O-paru-má below Santa Teresita de Kavanayén, *Steyermark 60544* (Type-collection, *S. caudata*) (fl.) Nov. 25, 1944 (A, F, NY, VEN). Brazil: Amazonas: Prope Panuré ad Río

Vaupés, *Spruce 2478* (Type-collection) (fl. & fr. immature) Oct. 1852–Jan., 1853 (F, GH, NY, S); Rio Solimões, medio Jundiatuba, *Fróes 23836* (fr.) Jan. 6, 1949 (BI).

36. **Sloanea zuliaensis** Pittier, Contrib. Fl. Venezuela 31. 1923.
S. macropoda Standley, Journ. Wash. Acad. Sci. **15:** 478. 1925.
S. microcephala Standley, Field Mus. Pub. Bot. **4:** 152. 1929.

Tree to 27 m. high (*fide* Little). Twigs moderately robust, striate, minutely fuscous-puberulent. Leaves alternate; stipules 12–20 mm. long, 4–6 mm. wide, lanceolate, naviculate, minutely puberulent, obtuse, undulate to repand-dentate; petioles 5.5–14.5 cm. long, terete, striate, incrassate at both ends, subpuberulent to puberulent; blade 21–40 cm. long, 8–23 cm. wide, ovate to, usually, elliptical, chartaceous to subcoriaceous, midrib and secondary veins distinct, puberulent above, midrib on the underside under-cut next to the blade so as to appear almost terete, midrib and secondary veins prominent, subpuberulent beneath, secondary veins 12–15, arcuate-ascending, base of blade subacute to rounded, apex obtuse to acuminate-obtuse or subacute, margin irregularly undulate to repand-dentate to prominently obtuse-dentate. Inflorescences 13–27.5 cm. long, pedicels cymosely arranged at the ends of the branches of the raceme, peduncles, pedicels and bracts minutely puberulent, peduncles 12–26 cm. long, striate, pedicels 5–12 mm. long, bracts subtending pedicels to 2 mm. long, deltoid to lanceolate, obtuse, bracts of the peduncle 3–10 mm. long, ovate, naviculate, entire to sparsely dentate, obtuse, occasionally 3-lobed; flowers yellow, fragrant, 2–3 mm. long, 2.5–4 mm. in diameter, sepals united into a 4–6-lobed plate beneath the broad receptacle, or margin of the calyx merely irregular, not lobed, puberulent within and without; stamens 1.5–2 mm. long, filaments to 0.5 mm. long, angled, glabrate, the anther-sacs and connective spreading and truncate so that, at anthesis, the stamens form a subglobose mass with a mosaic-like surface; pistil to 3 mm. long, ovary to 1.5 mm. long, 1 mm. in diameter, ovoid, 4-angled, 4-loculed, finely and densely puberulent, style to 1.5 mm. long, tapered from the base, at times 4-angled, glabrous, apex obtuse, entire. Capsule to 2.5 cm. long, 2 cm. in diameter, ellipsoidal, 1- or 2-seeded, usually 4-valved: valves 2–4 mm. thick, densely covered with reddish, semicurved, semiflexible spines; spines to 2.5 cm. long, tapered from the base, scarcely minutely puberulent. Seed to 15 mm. long, 7 mm. in diameter, ellipsoidal, almost completely covered with a 6-lobed aril, the 3 large lobes irregularly laciniate; aril firmly attached to the chalazal ⅓ of the seed.

Sloanea zuliaensis Pitt. is a very distinctive species readily distinguished by its long racemes of capsules, or by its flowers with their curious ball of stamens. No other species of *Sloanea* has this truncate stamen-condition, although closely adherent stamens are not uncommon in the genus. The moderately large persistent stipules and the one- or two-seeded capsules with a dense covering of tapered spines show the relationship of *S. zuliaensis* to *S. multiflora* and *S. lanceolata*. It is known locally in Panama and Costa Rica as "abrojo" and in Venezuela as "laurel."

S. zuliaensis has been collected both in Central America from Costa Rica through Panama and in South America in Venezuela (see Map 9).

Costa Rica: Bois de Boca Culebra, litoral du Pacifique, *Pittier 8120* (Type-collection, *S. macropoda*) (fr.) Jan. 21, 1898 (US). Panama: Canal Zone: Barro Colorado Island; *Kenoyer 433* (Type-collection, *S. microcephala*) (fl.) Aug. 6, 1927 (F, US); Colón: Along Río Sirri, Trinidad Basin, *Pittier 4028* (fl.) July 19–21, 1911 (F, US). Venezuela: Margenes del Río Lora, Zulia, *Pittier 10926* (fr.) Dec. 13, 1922 (GH, NY, US, VEN); *Pittier 10930* (Type-collection) (fl.) Dec. 13, 1922 (G, GH, NY, US, VEN).

Subgenus Quadrisepala nom. nov.

Arbores (raro frutices). Stipulae ante folia evolventia caducae. Inflorescentia axillaris (raro terminalis), paniculata, corymbosa, corymboracemosa, racemosa vel umbellata. Sepala 4, aequalia, stamina pistillaque praeanthesin tegentia. Capsulae sine spinis vel cum spinis rigidis vel irritantibus (raro spinis flexilibus). Type: *S. latifolia* (Rich.) Schum.

Section 3. Paniculi nom. nov.

Series *Paniculatae* and *Corymbulosae* Benth., Journ. Linn. Soc. **5:** suppl. 62. 1861. In part.

Arbores. Inflorescentia paniculata, pluri-flora. Sepala 4, aequalia; antherae plerumque quam filamenta longiores. Capsulae inermes vel raro cum aculeis densibus vel cum spinis rigidis densibus. Mostly north of the Amazon River to the Caribbean, one species in Central America and one species in the Lesser Antilles.

Type: *S. latifolia* (Rich.) Schum.

Key to Section 3. Paniculi

A. Stamens adhering in a mass at anthesis.
  B. Capsule to 6 cm. long; valves 4–5 mm. thick; spines stout, tapered, to 15 mm. long.....41. *S. durissima.*
  B. Capsule to 3 cm. long; valves 3 mm. thick, spines to 14 mm. long, tapered from the base; flowers unknown.....43. *S. petenensis.*
A. Stamens free at anthesis.
  C. Stamens 3–7 mm. long.
    D. Style puberulent on the basal ½–⅔.
      E. Anthers dehiscing by an apical pore; style tapered; capsules to 3 cm. long; spines to 10 mm. long, minutely puberulent.....42. *S. laxiflora.*
      E. Anthers dehiscing most of their length; style obclavate; capsule to 2.2 cm. long, unarmed or with a few scattered stout prickles to 5 mm. long.....38. *S. caribaea.*
  D. Style more or less glabrous.
    F. Anthers subulate; filaments almost as long as the anthers; ovary indistinctly 4-angled, wrinkled; capsule to 4 cm. long, ovoid, unarmed.....37. *S. floribunda.*
    F. Anthers lanceolate; filaments less than ⅓ the length of the anthers; ovary 4-lobed, smooth; capsule (immature) to 4 cm. long, oblique-obovoid, unarmed..39. *S. lasiocarpa.*

C. Stamens 6.5–11 mm. long.
G. Ovary sub-globose to obovoid, densely pubescent; capsule to 3.5 cm. long, unarmed or with a few spines to 3.5 mm. long.....40. *S. latifolia.*
G. Ovary ovoid, puberulent.
H. Style stout, puberulent; receptacle usually greater in diameter than the pedicel on which it is borne; capsule (immature) to 3 cm. long, ellipsoidal, scarcely granulose.....44. *S. synandra.*
H. Style subulate, finely puberulent to glabrate on the basal ⅓; pedicel usually of greater diameter than the receptacle at its apex; capsule to 3 cm. long, obovoid, 4-ridged, densely tuberculate.....45. *S. Schomburgkii.*

37. **Sloanea floribunda** Spruce ex Benth., Journ. Linn. Soc. **5:** suppl. 66. 1861.
S. paniculata Spruce ex Benth., Journ. Linn. Soc. **5:** suppl. 66. 1861.
S. longipes Ducke, Archiv. Inst. Biol. Veg. Rio de Janeiro **2:** 166. 1935.

Large tree with very large buttresses (*fide* Ducke). Twigs robust, gray, striate, new growth sulcate, glabrous. Leaves opposite to alternate; stipules ovate; petioles 1.2–4.5 cm. long, scarcely striate, canaliculate above, glabrous; blades 10-21.5 cm. long, 3.5–9.5 cm. wide, elliptical, firmly chartaceous to coriaceous, midrib and secondary veins prominent, glabrous above, less prominent, glabrous beneath, base subacute to rounded to subcordate, apex acuminate-obtuse to obtuse, margin entire. Inflorescences 6–15 cm. long, primary peduncles 3.5–8.5 cm. long, striate, glabrous to minutely and scarcely puberulent, cymosely branched, ultimate divisions paniculate, pedicels 1.3–2.5 cm. long, angled, striate, scarcely minutely puberulent; buds ovoid; flowers greenish-white with red pistil and receptacle (*fide* Ducke), 6–7 mm. long, 8–10 mm. in diameter, sepals 6–8 mm. long, 2.5–3.5 mm. wide, ovate, obtuse, entire, scarcely to densely minutely puberulent without and within; stamens 4–5 mm. long, filaments 1–2 mm. long, velutinous, at times somewhat flattened laterally, anthers 1.5–3 mm. long, subulate, base of sacs truncate, minutely puberulent, connective gradually prolonged into a minutely puberulent awn ⅓ to ⅔ the length of the anther-sacs; pistil 4–5 mm. long, ovary 2–3 mm. long, 1.5–2 mm. in diameter, ellipsoidal to subglobose, indistinctly 4-angled, 4-loculed, wrinkled, velutinous, style 2–3 mm. long, velutinous at the base, glabrous above, entire. Capsule to 4 cm. long, probably about 3 cm. in diameter, subglobose, 1-seeded, 4-valved; valves to 5 mm. thick, smooth without. Seed about 2 cm. long, about 1.4 cm. in diameter, ovoid, tending to be 4-angled, ⅘ covered by an irregular-margined white and reddish aril (*fide* Ducke) firmly attached to the seed-coat.

Sloanea floribunda Spruce ex Benth. belongs with the closely related species of Section *Paniculi* as can be seen in the 4-parted calyx completely covering the bud before anthesis, the compound cymose-paniculate inflorescences which extend beyond the terminal buds of the twigs, and the unarmed fruit. This species is widespread in the northern Amazon basin (see Map 6), but it is

not often collected. Bentham, apparently not realizing the great range of variation in *Sloanea* and having immature material of *Spruce 2714*, failed to recognize the conspecific nature of the two Spruce collections. Ducke, in describing this entity as *S. longipes*, was probably without adequate Spruce material, and did not recognize his collection as the previously described species.

BRAZIL: AMAZONAS: Prope Panuré ad Rio Vaupés, *Spruce 2714* (Type-collection, *S. paniculata*) (fl. immature) Oct., 1852–Jan., 1853 (F, GH, NY); Prope San Carlos ad Rio Negro, *Spruce 3680* (Type-collection) (fl.) 1853–54 (F, GH, NY); Manáos, Estrada do Aleixo; *Ducke 1154* (fr.) Dec. 29, 1942 (BI, MO, NY, US); PARÁ: Rio Macujubim (in aestuario Amazonico) *Ducke* Herb. Jard. Bot. Rio de Janeiro 18379 (Type-collection, *S. longipes*) (fl.) July 9, 1932 (S, US).

38. **Sloanea caribaea** Krug and Urban ex Duss, Flor. Ant. Franc. 90. 1897.

Large tree to 60 m. tall, trunk heavily buttressed, to 1 m. in diameter. Twigs slender, bark brown, finely striate, lenticels often conspicuous, new growth subpuberulent to very finely puberulent. Leaves alternate; petioles 0.5-1.5 cm. long, canaliculate above, often incrassate at both ends, glabrate; blade 4–10 cm. long, 2.5–6.5 cm. wide, elliptical to obovate, chartaceous, midrib and secondary veins impressed, glabrous above, prominent, glabrous to subpuberulent beneath, base generally acute to obtuse, apex obtuse to acuminate-obtuse, margin entire. Inflorescences 5–7.5 cm. long, cymose-paniculate, primary peduncle 3–5.5 cm. long, striate to terete, scantily puberulent to puberulent, pedicels 4–12 mm. long, often angled, striate, scarcely puberulent to puberulent; buds broadly ovate; flowers "cream-white, with strong sweet odor" (*fide* Beard), 4–5 mm. long, 5–8 mm. in diameter, sepals 4–5 mm. long, 2–3 mm. wide, ovate, obtuse, entire, puberulent without, puberulent, nerves prominent within; stamens 3–4 mm. long, filaments 0.5–1 mm. long, often laterally flattened, puberulent to velutinous, anthers 2–3 mm. long, deltoid-linear, minutely puberulent, connective prolonged into a short glabrate awn which may be somewhat laterally flattened; pistil 4–5 mm. long, ovary 1–1.5 mm. long, 1–1.25 mm. in diameter, subovoid, 4-angled, 4-loculed, densely puberulent, style 2–3 mm. long, obclavate, narrowing abruptly toward the apex, angled, striate, puberulent on the basal ⅔, apex entire. Capsule 2–2.2 cm. long, 1.8–2 cm. in diameter, 1–2-seeded, 4-valved; valves 2–3 mm. thick, surface minutely granulose, unarmed, or with few scattered stout prickles to 5 mm. long. Seed 11–15 mm. long, 7–10 mm. in diameter, ellipsoidal to irregularly ovoid, from ¾ to almost entirely covered by a dark aril firmly attached to the chalazal ½ of the seed; margin of the aril irregular (indefinitely 3-lobed).

Sloanea caribaea Krug & Urban ex Duss was originally described from Guadeloupe, but it is now known to be in the rainforest of many of the Lesser Antillean islands. In addition an extension of range into Venezuela and the upper Amazon of Brazil is now known, with a curious lack of collections from Trinidad and the Guianas (see Map 6).

This species is very closely related to *S. floribunda* but it differs in the short petioles incrassate at both ends, the smaller inflorescences and flowers, and, particularly, in the short staminal awns, the obclavate style, and the dark aril of the seed.

ST. LUCIA: La Falage, *Beard 181* (fl.) Dec. 15, 1943 (A); Quillesse to Morne Troumasse, *Howard 11655* (fr.) May 11, 1950 (GH). GUADELOUPE: Bois de Bains-Jaunes, *Duss 2348, 3485* (Type-collection) (fl. & fr.) July 15, 1894–97 (F, GH, MO, NY, US). DOMINICA: Sylvania, Morne Colla Anglais, *Hodge 537* (fl.) Aug. 10–23, 1938 (GH, NY, US). GRENADA: Grand Etang, *Beard 162* (fr.) Dec. 2, 1943 (A). VENEZUELA: Aragua, Parque Nacional: Lomas al oeste del paso de Rancho Grande, *Pittier 15357* (fl. & fr.) Apr. 17, 1947 (US, VEN); La Mesa, *Pittier 15721* (fr. immature) Jan. 26, 1948 (US, VEN). COLOMBIA: META: Sierra de La Macarena, Central Mts., *Phillipson, Idrobo* and *Jaramillo 2032* (fr.) Jan. 6, 1950 (US). BRAZIL: AMAZONAS: Municipality São Paulo de Olivença, basin of creek Belém, *Krukoff 8651* (fl. immature) Oct. 26–Dec. 11, 1936 (A, F, K, MO, NY, S, US).

39. **Sloanea lasiocarpa** Pittier, Bol. Soc. Ven. Cienc. Nat. **6:** no. 41; 11. 1939.

Tall tree (*fide* Pittier). Twigs stout, deeply striate, light-brown, scattered-puberulent, new growth striate, finely puberulent. Leaves alternate; petioles 5.5–10 cm. long, striate, glabrate, more or less incrassate at both ends; blades 14.4–24.5 cm. long, 10.5–14.5 cm. wide, ovate, chartaceous, midrib and secondary veins distinct, glabrate above, prominent, glabrate to scattered-puberulent beneath, base broadly rounded, apex acuminate-obtuse, margin irregularly undulate. Inflorescences 4.5–9 cm. long, paniculate, primary peduncle 3–7.5 cm. long, striate, finely puberulent, pedicels 2–3 mm. long, striate, densely puberulent; buds ovoid; flowers (immature) with sepals to 8 mm. long, 5 mm. wide, ovate, densely finely puberulent within and without, nerves prominent within; stamens 4–5 mm. long, filaments 0.5–0.75 mm. long, puberulent, anthers 3–4 mm. long, lanceolate, scattered-puberulent, the connective prolonged into a short, stout, obtuse, glabrous awn; pistil to 6 mm. long, ovary to 2.5 mm. long, to 2 mm. in diameter, subglobose, more or less 4-lobed, short-puberulent, style to 3.5 mm. long, tapered from the base, glabrous, apex entire. Capsule (immature) to 4 cm. long, oblique-obovoid, 4-valved, surface finely puberulent, verruculose. Seed not seen.

Sloanea lasiocarpa Pitt. is a distinct species related to *S. caribaea* as is shown by its unarmed capsule, lanceolate stamens and long-peduncled inflorescence. In the collections seen, the broadly ovate leaves are distinctive of the species (foliage is seldom markedly distinct in *Sloanea*). This is a species of the montane rainforests of Venezuela (see Map 6).

VENEZUELA: Selvas del Avila: *E. Delgado 276* (Type-collection) (fl. immature) Aug. 24, 1939 (VEN); *Delgado 148* (fr. immature) (US, VEN).

40. **Sloanea latifolia** (Rich.) K. Schumann in Mart., Fl. Bras. **12** (3): 173, tab. 35, fig. 1. 1886.

Blondea latifolia Richard, Act. Soc. Paris **1:** 110. 1792.
Sloanea corymbiflora DeCandolle, Prodromus **1:** 516. 1824.
S. inermis Ducke, Archiv. Inst. Biol. Veg. Rio de Janeiro **4:** 48. 1938.

Tree to 20 m. tall, trunk buttressed. Twigs with light-brown, finely striate bark; new growth finely yellowish-puberulent-striate, lenticels often numerous, elongate. Leaves opposite to alternate; petioles 1–10 cm. long, subterete, striate, incrassate at both ends, subcanaliculate at the apex above, glabrate to finely puberulent; blade 7–34 cm. long, 3–18 cm. wide, lanceolate (in *Fróes 21363*) to elliptical to obovate, thick-chartaceous to coriaceous, midrib and secondary veins often light in color, subprominent, glabrous to finely puberulent above, prominent, glabrous to finely puberulent beneath, base subacute to cuneate-acute, apex short-acuminate to acuminate, obtuse to acute, margin entire to irregularly subundulate. Inflorescences 4.5–5 cm. long, primary peduncle 2–9.5 cm. long, striate, finely tomentulose, occasionally persistent bracts 3–6 mm. long, deltoid-ovate, entire, obtuse, finely tomentulose, pedicels 5–20 mm. long, angled-striate, finely tomentulose; buds ovoid to lanceolate-ovoid; flowers white with yellow stamens, 10–12 mm. long, 7–9 mm. in diameter, sepals reflexed at anthesis, 7–15 mm. long, 1.5–4 mm. wide, lanceolate-ovate, obtuse, finely tomentulose without, striate, finely tomentulose within; stamens 7–10 mm. long, filaments 1.5–2.5 mm. long, the longer borne abaxially, laterally flattened, glabrous to minutely puberulent, anthers 3–7 mm. long, linear, the base abruptly subcordate, glabrate, dehiscing through an apical pore, connective prolonged into a short glabrous awn; pistil 9–13 mm. long, ovary 1–2 mm. long, 1–2 mm. in diameter, subglobose to obovoid, striate, 4-angled, 4-loculed, densely pubescent, style 6.5–11 mm. long, flagelliform, exserted above the stamens, more or less angled, puberulent on the basal ⅕ to ½, glabrous above, apex entire. Capsule 3–3.5 cm. long, probably about 3 cm. in diameter, subglobose, 1-seeded, 4-valved; valves reflexed at maturity, 4–9 mm. thick, finely granulose, unarmed or with a few spines to 3.5 mm. long, conical, densely puberulent. Seed to 2.5 cm. long, 2 cm. in diameter, the apical ½ irregularly hemispherical with a large hilum, the chalazal ½ thimble-shaped and covered with a white or cream-colored, sweet-tasting (*fide* Ducke), 3-(4?)-lobed aril; margin of the lobes irregularly lacerate, the aril firmly attached to the seed coat except at its margin.

Sloanea latifolia (Rich.) Schum. has become a nomenclatural tangle through the years because of the great variation in foliage and inflorescence-size. Described originally as *Blondea latifolia* by Richard from a LeBlond specimen, the nomenclatural transfer to *Sloanea* was made by Schumann in 1886. He correctly placed DeCandolle's *S. corymbiflora* in synonymy under *S. latifolia.* Subsequently, Ducke described a form with smaller leaves and shorter inflorescences as *S. inermis.* Having examined the Ducke type-collection and the LeBlond type-collection (from Richard's own herbarium) I can find no floral differences. The fruit was unknown prior to the DeCandolle description, but DeCandolle's reference to fruit without setae agrees with the fruit which I have seen.

Sloanea latifolia is another of the very closely related species of section *Paniculi*. It differs from the other species in its large flowers, long linear anthers, flagelliform style and in its curiously shaped seed ½ covered by an aril. The seed is borne on an especially large funiculus which expands at the apex leaving a large scar on the mature seed. The funiculus remains in the mature capsule as an appendage, basally attached and separate from the valves of the capsule. The oily endosperm and the cotyledons conform to the exterior shape of the seed, the endosperm being hemispherical at the hilar end, and thimble-shaped at the opposite end.

The species is a tree of high ground in the rainforest of Guiana (where it is commonly called "aruadan") and the upper Amazon basin (where it is locally known as "urucú-rana," the name generally applied to *Sloanea*) (see Map 6).

French Guiana: Region de Cayenne, *Santini s. n.* (fl.) Aug., 1910 (L); *LeBlond 209* (Type-collection) (fl.) 1792 (G, P). British Guiana: Kamuni Creek, Groete Creek, Essequibo River, *Maguire* and *Fanshawe 22908* (fr.) Apr. 20, 1944 (K); 20 miles Bartica-Potaro Road, Forest Dept. field F-2726, record 5525 (fr.) Oct. 29, 1947 (K). Brazil: Amazonas: Manáos: mata das terras altas além Flores, *Ducke 1922* (fr.) Mar. 1, 1946 (A, BI, F, NY, US); *Ducke* Herb. Jard. Bot. Rio de Janeiro 34987 (Type-collection, *S. inermis*) (fl. & fr. immature) Oct. 3, 1936 (NY, S, US); Rio Negro, Vila Içana, *Pires 440* (fl.) Apr. 20, 1947 (GH); São Paulo de Olivença near Palmares, *Krukoff 8555* (fl.) Oct. 26, 1936 (F, K, MO, NY, S, US).

41. **Sloanea durissima** Spruce ex Bentham, Journ. Linn. Soc. **5:** suppl. 65. 1861.

Tree to 28 m. high, trunk buttressed on lower 2.5 m., 0.5 m. in diameter above buttresses (*fide* Forest Dept. British Guiana). Twigs with brown bark, more or less striate, glabrous or finely rust-brown-tomentulose. Leaves alternate to subopposite; petioles 0.5–8.5 cm. long, subterete, striate, incrassate at both ends, glabrous or finely brown-tomentulose; blades 9–25.5 cm. long, 4–12 cm. wide, ovate to elliptical to obovate to oval, coriaceous, midrib and secondary veins distinct, glabrous to minutely puberulent above, prominent, glabrous to rusty-puberulent beneath, both leaf surfaces glabrous to puberulent over-all; base obtuse to subacute, apex usually short-acuminate, obtuse to acute, margin subentire to irregularly undulate. Inflorescences 9–18 cm. long, primary peduncle 4.5–12 cm. long, substriate, more or less laterally flattened, rusty-puberulent, pedicels 8–15 mm. long, angled-striate, rusty-tomentulose, often tapered upward to the calyx; buds broadly ovoid; flowers cream, about 10 mm. long, 25 mm. in diameter from tip to tip of the spreading sepals; sepals to 14 mm. long, 4 mm. wide, thick, fleshy, rusty-tomentulose without and within, nerves prominent within; stamens adhering in a mass, the shorter stamens to the outside, 5–8 mm. long, filaments 0.5–1.5 mm. long, often laterally flattened, puberulent to pubescent, anthers 2–7 mm. long, linear, puberulent to pubescent, marked with a longitudinal line laterally, dehiscing by

a pore at the apex, connective often deeply grooved ab- or adaxially, continued into an awn; awn short on the inner stamens, to 1 mm. long on the outer stamens, glabrous or with scattered hairs; pistil 8–8.5 mm. long, ovary to 3 mm. long, 3 mm. in diameter, globose, 4-loculed, indistinctly 4-angled, tawny-pubescent, style 5–6 mm. long, tapered from the base, pubescent on the basal ½, glabrous above, apex entire. Young fruit obovoid, rusty-tomentulose with few short spines. Capsule to 6 cm. long, 4-valved, the valves 4–5 mm. thick, with numerous stout tapered spines to 15 mm. long; valves spreading at maturity.

Sloanea durissima Spruce ex Benth. has been infrequently collected. It also is a tree of high land in rainforest like the preceding species. This species may be distinguished from other species of Section *Paniculi* by the pubescent stamens adhering in a mass, the spreading sepals, and by the large, stoutly spined capsule. This species is also known as "aruadan" in British Guiana.

S. durissima has been collected in British Guiana and Amazonas, Brazil (see Map 6).

British Guiana: Mahdia River, Potaro River, 107 miles Bartica-Potaro Road, Forest Dept. field F-1081, record 3817 (fl. & fr. immature) Jan. 23, 1943 (K). Brazil: Amazonas: Prope Panuré ad Rio Vaupés, *Spruce 2788* (Type-collection) (fl.) Oct., 1852–Jan., 1853 (NY); Basin of Rio Jurua, near mouth of Rio Embira, *Krukoff 5072* (fr.) June 28, 1933 (A, F, G, K, MO, NY, S, US).

42. **Sloanea laxiflora** Spruce ex Bentham, Journ. Linn. Soc. **5:** suppl. 65. 1861.

S. acutiflora Uitt., Rec. Trav. Bot. Néerl. **22:** 357. 1925.

S. polyantha Ducke, Archiv. Instit. Biol. Veg. Rio de Janeiro **2:** 162. 1935.

Tree 15 m. high (*fide* Pires), trunk buttressed. Twigs with light-brown, indistinctly striate bark, new growth striate, finely pubescent. Leaves alternate; petioles 0.5–1.5 cm. long, subterete, striate, glabrous, often dark in color, blade 4.5–15 cm. long, 2.5–8 cm. wide, ovate to elliptical, subcoriaceous, midrib and secondary veins distinct above, prominent beneath, glabrous, base rounded, apex acuminate-acute to obtuse, margin more or less entire, leaves tending to be conduplicate. Inflorescences often terminal, 5–11 cm. long, primary peduncle 3–5.5 cm. long, striate, minutely puberulent, pedicels 5–10 mm. long, angled-striate, minutely puberulent; buds ovoid; flowers white with yellow stamens (*fide* Ducke) or yellowish (*fide* Klug), 6–10 mm. long, about 10 mm. in diameter, the sepals apparently soon falling, 6–10 mm. long, 2–5 mm. wide, ovate, puberulent within and without, the veins distinct within, stamens 3–7 mm. long, filaments 0.5–1 mm. long, laterally flattened, minutely puberulent, often dark in color, anthers 2–5.5 mm. long, linear, minutely puberulent to scarcely pubescent, dehiscing through an apical pore, connective grooved on the adaxial side, usually broad and often dark in color on the abaxial side, prolonged into a small, short, glabrous awn; pistil 4–9 mm. long, ovary 1.5–2.5 mm. long, 1.5 mm. in diameter, ellipsoidal, indistinctly ridged, 4-angled, 4-

loculed, pubescent, style 2–6 mm. long, tapered, puberulent on the basal ½ to ⅔, glabrous above, apex entire. Capsule pale-yellow (*fide* Ducke), 2.5–3 cm. long, about 2.5 cm. in diameter, subglobose, 1-seeded, 4-valved; valves reflexed at maturity, 2 2.5 mm. thick, densely covered with subrigid spines; spines 8–10 mm. long, tapering abruptly from the base, then more gradually to the apex, minutely puberulent. Seed white (*fide* Ducke) to 2.3 cm. long, 1.8 cm. in diameter, irregularly ellipsoidal, the chalazal ½ covered with a firmly adherent, 3-lobed pale-yellow aril; margin of the lobes irregular.

Sloanea laxiflora Spruce ex Benth. has a range closely parallel to *S. durissima* except for the westward extension into the Amazon area of Peru (see Map 6). It can be differentiated from the other species in this section by the puberulent stamens with small short awns, the almost complete lack of an enlarged receptacle and by the yellow capsule with its subrigid spines and white seed. Again, this appears to be a species of upland rainforest primarily in the Amazon basin.

There is no doubt that *S. polyantha* Ducke is a synonym of *S. laxiflora*. The fruit was unknown to Bentham, but the flowering material of the Spruce type and the Ducke type are almost identical, character for character. *S. acutiflora* Uitt. I have brought into synonymy because I do not feel that the difference in length of the capsular spines is sufficient to justify a separate species. There is no difference in floral characters beyond the expected range of variation in size and indument.

VENEZUELA: Ad flumina Casiquiari, Vasiva et Pacimoni, *Spruce 3376* (Type-collection) (fl.) 1853–54 (F, GH, NY). DUTCH GUIANA: Fluv. Tapanahoni, prope Manlobbi, *J. W. Gonggrijp 3701* (fr.) Feb., 1924 (NY); Forest Reserve, Brownsberg, tree 1214:—Forestry Bur. 6298 (Type-collection, *S. acutiflora*) (fl.) Oct. 27, 1923 (L, US). BRITISH GUIANA: Mahdia River, Potaro River, 107 miles Bartica-Potaro Road, Forest Dept. field F-1022, record 3758 (fl.) Jan. 13, 1943 (K). BRAZIL: AMAZONAS: São Felipe, upper Rio Negro, *J. T. Baldwin 3578* (fr.) Mar. 10, 1944 (BI, US); Manáos, Estrada do Aleixo, *Ducke 1853* (fr.) Jan 4, 1946 (A, BI, F, NY, US); Ponte do Mindú, *Ducke* Herb. Jard. Bot. Rio de Janeiro 25118 (Type-collection, *S. polyantha*) (fl.) Oct. 29, 1929 (S, US); Rio Vaupés, Taraquá, *Pires 931* (fl.) Nov. 9, 1947 (GH). PERU: LORETO: Iquitos, lugar Punchana, *Ducke 1833* (fl.) Nov. 10, 1945 (A, BI, F, NY, US).

43. **Sloanea petenensis** Standley & Steyermark, Field Mus. Pub. Bot. **23:** 172. 1944.

Tree to 30 m. tall. Twigs with light-brown, more or less striate bark. Leaves alternate; stipules to 4 mm. long, subulate, scarcely puberulent to puberulent; petioles 4.5–6 cm. long, slender, terete, scarcely striate, glabrate; blade 17–28 cm. long, 6–10 cm. wide, narrowly elliptical to ovate, firmly membranaceous, midrib and secondary veins glabrous, distinct above and below, base obtuse to acute, apex short- to long-acuminate, obtuse, margin irregularly

undulate. Inflorescences unknown. Capsule borne on a peduncle 1.5 cm. long. Capsule to 3 cm. long, ellipsoidal, 4-valved, valves to 3 mm. thick, densely covered with rigid spines; spines to 14 mm. long, puberulent, tapered abruptly from the base, then more gradually to the apex. Seed unknown.

Sloanea petenensis Standl. & Steyerm. was originally described from poor material. Except for a collection from Ecuador with a similar capsule attached to similar foliage, there would be reasonable doubt that the capsule in the Guatemala collection belongs with the foliage. The capsule compares favorably with the capsule of *S. Picapica* Standl. of section *Brachystachyae*. It is hoped that subsequent collections will verify the application of this specific name.

S. petenensis has been collected only in Guatemala and Ecuador (see Map 10).

GUATEMALA: PETÉN: Forest between Finca Yalpemech and San Diego, *Steyermark 45309* (Type-collection) (fr.) Mar. 25, 1942 (F, US). ECUADOR: ESMERALDAS: Santo Domingo to Quinindé, *Little 6203* (fr.) Apr. 8, 1943 (US).

44. **Sloanea synandra** Spruce ex Bentham, Journ. Linn. Soc. **5:** suppl. 66. 1861.
S. macrantha Ducke, Archiv. Instit. Biol. Veg. Rio de Janeiro **2:** 162. 1935.

Large tree, trunk with radiating buttresses (*fide* Ducke). Twigs stout, striate, sulcate, tawny-puberulent. Leaves alternate, with the odor of hydrocyanic acid (*fide* Ducke); petioles 3–8 cm. long, terete, striate, tawny-puberulent; blade 12.5–28 cm. long, 8.5–16 cm. wide, ovate to oval to obovate, coriaceous, at times rugose, nitidulous above, midrib and secondary veins distinct, minutely puberulent to glabrate above, prominent, minutely puberulent to glabrous beneath, base rounded to subcordate, apex usually short-acuminate-acute, margin entire to irregularly undulate. Inflorescences 5.5–20 cm. long, branchlets flushed pale-crimson; primary peduncles 2.5–10.5 cm. long, striate, finely puberulent; pedicels 1–2.5 cm. long, striate, finely puberulent, expanding abruptly at the apex; buds broadly ovoid, creamy (*fide* For. Dept. Brit. Guian.); flowers rose-pink (*fide* For. Dept.), cream or white with yellow stamens (*fide* Ducke), 1.3–2 cm. long, 1.5 cm. in diameter; receptacle large, usually exceeding the pedicel on which it is borne; sepals 13–20 mm. long, 6–12 mm. wide, minutely puberulent to puberulent within and without; stamens 7–11 mm. long, the longer toward the center of the flower, the outermost reduced to staminodia, filaments very short, the longest about 0.5 mm. long, glabrous, anthers 5–10.5 mm. long, linear-lanceolate, puberulent to pubescent, opening by a pore at the apex, awns 0.5–1.5 mm. long, the staminodia almost all awn with only rudimentary anthers; pistil 9–12 mm. long, ovary 3–5 mm. long, 2–5 mm. in diameter, ovoid, 4-loculed, 4-angled, rugose, minutely puberulent, style 6–10 mm. long, 4-angled, stout, minutely puberulent on the basal ⅓ to ½, apex entire. Capsule (immature) 3 cm. long, 1.5 cm. in diameter, ellipsoidal, 4-valved, scarcely granulose. Seed unknown.

Sloanea synandra Spruce ex Benth. is very similar to the following species, *S. Schomburgkii*. It can be distinguished from the latter by its thicker, pubescent, long-awned anthers opening by a large pore, by its usually thicker style, and by the enlarged receptacle which usually exceeds the diameter of the pedicel on which it is borne. Also, the mature capsule of this species probably much exceeds the capsule of *S. Schomburgkii* in size.

The range of *S. synandra* is similar to that of many of the species in this section having been collected in British Guiana (where it is locally called "shirabuliballi"), and in the upper Amazon basin (see Map 5). It is found in higher (non-flooded) habitats in rainforest.

BRITISH GUIANA: Mahdia River, Potaro River, 107 miles Bartica-Potaro Road, Forest Dept. field F-991, record 3727 (fl.) Jan. 9, 1943 (K). BRAZIL: AMAZONAS: Esperança, ad ostium flum. Javary, *Ducke* Herb. Jard. Bot. Rio de Janeiro 25112 (Type-collection, *S. macrantha*) (fl.) Sept. 19, 1931 (US, S); *Ducke 1094* (fl. & fr. immature) Oct. 29, 1942 (GH, MO, NY, US); Prope Panuré ad Rio Vaupés, *Spruce 2607* (Type-collection) (fl.) Oct. 1852–Jan. 1853 (F, GH, NY).

45. **Sloanea Schomburgkii** Bentham, Journ. Linn. Soc. **5:** suppl. 66. 1861.
S. verrucosa Ducke, Archiv. Instit. Biol. Veg. Rio de Janeiro **2:** 165. 1935.

Tree to 30 m. tall, buttressed to 1.6 m. above the ground (*fide* Forest Dept. Brit. Guiana). Twigs usually stout, bark light-brown, scarcely striate, new growth striate, densely puberulent. Leaves opposite; petioles 2–9.5 cm. long, terete, often striate, scarcely incrassate at both ends, glabrous to puberulent; blade 11.5–29 cm. long, 7–16 cm. wide, ovate to elliptical to obovate, coriaceous, often rugose, midrib and secondary veins distinct to impressed, glabrous to puberulent above, prominent, glabrate to scattered-pubescent beneath, base acute to rounded, apex obtuse to acuminate-obtuse to acuminate-acute, margin entire to scarcely undulate. Inflorescences 5.5–16.5 cm. long, primary peduncles 1.8–7 cm. long, somewhat laterally flattened, angled-striate, more or less finely puberulent, tapered upward to the branches; pedicels thick, 1–2 cm. long, angled-striate, more or less finely puberulent, tapered gradually to the apex which flares outward to a width equalling or greater than the width of the receptacle; flowers pink with yellow stamens and a caryophyllaceous fragrance (*fide* Ducke) or pale cream (*fide* Forest Dept. Brit. Guiana), to 12 mm. long, 12 mm. in diameter, sepals 12–17 mm. long, 4–9 mm. wide, reflexed at anthesis, thick, ovate, obtuse, finely puberulent within and without; stamens 6.5–9 mm. long, the longer borne toward the center, at times the outermost reduced to linear staminodia, filaments 0.5–2.5 mm. long, angled, sometimes laterally flattened, glabrate, anthers 5–7 mm. long, linear, glabrous, usually opening by a small, almost circular, pore at the apex, connective wide, with scattered ascending trichomes on the abaxial side, grooved, glabrate on the adaxial side, continued into a small, short awn in the central stamens, awn often somewhat longer in the outermost stamens; pistil 9–13 mm. long, ovary 2–3.5 mm. long, 1.5–2 mm. in diameter, ovoid, 4-angled, 4-loculed, very finely puberulent,

style 6–9 mm. long, subulate, angled, finely puberulent to glabrate on the basal ⅓, glabrous above, apex entire. Capsule dark-brown-dotted (*fide* For. Dept. Brit. Guiana), to 3 cm. long, 2.5 cm. in diameter, obovoid, 4-ridged, 1-seeded, 4-valved; valves to 3 mm. thick, surface finely puberulent, densely tuberculate. Seed red (*fide* For. Dept. Brit. Guiana), to 2 cm. long, 1.7 cm. in diameter, obovoid, covered almost entirely with an irregularly shallowly lacerate-margined aril.

Sloanea Schomburgkii Benth. is readily confused with *S. synandra* unless flowering material collected at or before anthesis is available. The fruits may also be distinct, but I have not seen mature capsules of *S. synandra*. The stamens of *S. Schomburgkii* are linear, almost glabrous, with longer filaments, and the anthers usually opening by a much smaller, almost circular pore. The pore of the anthers of *S. synandra* is larger and lenticular. Characters of the foliage and inflorescences are not consistently distinct in the two species. The most usually reliable foliar character is the generally opposite arrangement of the leaves of *S. Schomburgkii* as opposed to the generally alternate placement in *S. synandra*. The apex of the pedicel is usually of greater diameter than the receptacle in the former species, while the receptacle is usually larger than the pedicel in the latter species; although this character is not infallible, it will be found to be generally useful.

Along with the similarity in morphological characters in the two species is a close correlation in range and habitat. *S. Schomburgkii* is also found on higher land in the rainforest of British Guiana and the upper Amazon drainage (see Map 5).

BRITISH GUIANA: *Schomburgk 773* (Type-collection) (fl.) 1841 (P); Mazaruni Station, Forest Dept. field F-510, record 3246 (fl.) July 5, 1940 (K); Groete Creek, Essequibo River, Forest Dept. field F-1758, record 4494 (fr. immature) Mar. 10, 1944 (K). BRAZIL: AMAZONAS: Manáos, Rio Farumá, *Ducke* Herb. Jard. Bot. Rio de Janeiro 25113 (Type-collection, *S. verrucosa*) (fl. & fr.) Feb. 14, 1933 flor., Apr. 20, 1933 fruct. (S, US). MATTO GROSSO: Near Tabajaza, upper Machado River region, *Krukoff 1339* (fl. past anthesis) Nov., Dec., 1931 (K).

SECTION 4. CORYMBO-RACEMI NOM. NOV.

Section *Brachystachyae* Benth., Journ. Linn. Soc. **5:** suppl. 63. 1861. In part.

Arbores (raro frutices). Inflorescentia corymbosa vel corymbo-racemosa vel racemosa, raro umbellata, raro uniflora, axillaris. Sepala 4 (raro 5), aequalia; antherae et filamenta aequalia vel filamenta longiora. Capsulae inermes vel cum spinis rigidis vel cum spinis brevibus et irritantibus (raro spinis flexilibus). Throughout the range of *Sloanea* in the Americas with one species in Central America, two species in the West Indies. Type: *S. monosperma* Vell.

Key to Section 4. Corymbo-racemi

A. Inflorescences umbellately 1–3-flowered, or sub-umbellate.
  B. Receptacle with a distinct corrugated rim at the margin.
    C. Style to 4 mm. long; known only from the Amazon basin; capsule unknown.....48. *S. Kuhlmannii.*
    C. Style to 2 mm. long; known only from the Greater Antilles; capsule to 2.5 cm. long, sub-globose; spines to 1.5 mm. long, irritant.....53. *S. amygdalina.*
  B. Receptacle without a rim at the margin.
    D. Filaments and anthers pubescent, awn filiform, 1–2 mm. long; ovary long-pubescent; style contorted; capsule to 3.5 cm. long; spines to 2 mm. long, scarcely clavate, irritant, generally yellowish.....51. *S. Garckeana.*
    D. Filaments and anthers at most puberulent; awn thick, 0.5–1 mm. long; ovary at most pubescent; style straight; capsule to 2.5 cm. long; spines to 2 mm. long, clavate, irritant, generally red or maroon .....52. *S. terniflora.*
A. Inflorescences corymbose, corymbo-racemose, racemose or single-flowered.
  E. Inflorescences corymbose, corymbo-racemose or single-flowered.
    F. Inflorescences corymbose or single-flowered; ovary 4-angled; capsules armed with rigid spines.
      G. Inflorescences single-flowered.
        H. Perianth of 2 whorls of 4 members each; endemic to Jamaica; filaments 1–3 mm. long, puberulent, laterally flattened; awn to 0.5 mm. long, puberulent; capsule to 8 cm. long, ellipsoidal; spines to 5.5 mm. long, puberulent to glabrate.....46. *S. jamaicensis.*
        H. Perianth of 4 sepals only; known only from southeastern Brazil; filaments 1–2 mm. long, terete, puberulent; awn stout, short, puberulent; capsule to 1.5 cm. long, sub-globose; spines to 7 mm. long, hispid.....56. *S. lasiocoma.*
      G. Inflorescences corymbose; filaments 0.25 mm. long, glabrous; awn to 1 mm. long, glabrous; capsule to 3 cm. long, broadly ellipsoidal; spines to 2.5 cm. long, pubescent.....47. *S. nitida.*
    F. Inflorescences corymbo-racemose; capsule unarmed or armed with flexible spines.
      I. Capsules armed with spines.
        J. Spines of capsule to 1.5 cm. long; capsule to 3 cm. long; anthers 1–1.5 mm. long, linear, minutely puberulent; style entire.....54. *S. grandis.*
        J. Spines of capsule to 6 mm. long; capsule to 3 cm. long, ellipsoidal; flowers unknown.....60. *S. Dussii.*
      I. Capsules unarmed, puberulent, granulose.
        K. Capsule to 5 cm. long, subglobose; flowers unknown. 62. *S. grossa.*
        K. Capsule to 3.5 cm. long, subglobose to ellipsoidal; anthers 0.25–1 mm. long, deltoid-lanceolate, glabrous to puberulent; style 2–4 parted.....57. *S. laurifolia.*

E. Inflorescences racemose.
L. Style entire at the apex; ovary sub-globose, 4–5-angled; capsule to 3 cm. long, ellipsoidal; spines to 2 mm. long, clavate, irritant.....50. *S. porphyrocarpa.*
L. Style 4-parted at the apex.
M. Stamens always with a short stout awn; ovary smoothly ellipsoidal; capsule (immature) to 1.5 cm. long, ovoid; spines to 0.75 mm. long, clavate, irritant.....49. *S. erismoides.*
M. Stamens with a knob or, occasionally, a short awn; ovary smoothly sub-globose or ovoid, or angled.
N. Capsule 3 cm. long or longer; anthers 1–2 mm. long; species of the West Indies or southeastern Brazil.
O. Filaments 0.5–1.5 mm. long, uniform diameter throughout their length; ovary not angled; capsule to 3 cm. long, ellipsoidal; spines to 7 mm. long, clavate, irritant; Southeastern Brazil .....55. *S. monosperma.*
O. Filaments 1.5–3 mm. long, tapered from the base; ovary 4-angled; capsule to 3.5 cm. long, ellipsoidal, unarmed, puberulent; West Indies. 48. *S. Berteriana.*
N. Capsule to 2.5 cm. long; anthers 0.5–1 mm. long; species primarily of northern South America.
P. Filaments 1–2.5 mm. long, puberulent; capsule to 2.5 cm. long, unarmed or with scattered stout prickles.....59. *S. Fendleriana.*
P. Filaments to 1.5 mm. long, pubescent; capsule immature, densely covered with stout conical spines to 5 mm. long.....61. *S. echinocarpa.*

46. **Sloanea jamaicensis** Hooker, Ic. Pl. **7**: tt. 693–696. 1844.

Tree to 30 m. high. Branchlets with light-brown, finely striate bark; twigs angled-striate, scattered-puberulent. Leaves alternate; stipules to 6 mm. long, lanceolate, entire, obtuse, pubescent, caducous before the development of the leaf; petioles 1.5–4 cm. long, subcanaliculate above, more or less incrassate at both ends, at times striate, glabrous to scattered-puberulent; blades 10.5–21 cm. long, 6.5–12 cm. wide, obovate to elliptical to broadly elliptical, chartaceous, midrib and secondary veins distinct to sub-impressed, glabrous to scattered-puberulent above, prominent, glabrous to scattered-puberulent beneath, base subacute to rounded to subcordate, apex obtuse to short-acuminate, margin irregularly undulate. Inflorescences single-flowered, pedicels 1.5–2 cm. long, angled-striate, finely puberulent, biarticulate, flowers yellowish-brown with yellow stamens (*fide* Harris and Britton), 1–1.5 cm. long, 1.5–2 cm. in diameter, perianth-parts in two whorls of 4 members each, parts of the outer whorl 12–17 mm. long, 8–11 mm. wide, ovate, entire, broadly short-obtuse-acuminate, minutely puberulent within and without, inner whorl to 13 mm. long, 9 mm. wide, ovate, entire to tridentate, minutely puberulent within and without; stamens 7–9 mm. long, filament 1–3 mm. long, flattened laterally, finely puberulent, anthers 4.5–5 mm. long, lanceolate, minutely puberulent, connective broad, minutely puberulent, continued into an obtuse minutely puberulent awn to 0.5 mm. long; pistil to 9 mm. long, ovary 2 mm. long, 3 mm. in diameter, subglobose, 4-loculed, densely pubescent, style to 7 mm. long,

slender, angled, puberulent at the base, tapered gradually to the entire obtuse apex. Capsule to 8 cm. long, about 5.5 cm. in diameter, ellipsoidal, 4-loculed (?), about 3 seeds per locule in an immature capsule, 4-valved, valves 9-11 mm. thick, woody, surface densely spiny; spines to 5.5 mm. long, gradually tapered from the base, very finely puberulent to glabrate. Seeds (immature) to 12 mm. long, 7 mm. in diameter, somewhat curved, ellipsoidal, aril apparently almost covering the seed, irregularly margined.

Sloanea jamaicensis Hook., endemic to Jamaica, is an anomalous species in the New World *Sloanea* as it is the only species described as having "petals." Probably the term "petals" for the innermost whorl of perianth parts is a misnomer, they being, instead, the sepals of the flower. The outer whorl of "sepals" is apparently an involucre which has evolved from bracts on or at the base of the pedicel. Although single-flowered inflorescences are not unknown in other species of the genus, they are not at all common. The reduction of a complex inflorescence to a single articulated pedicel has apparently resulted in foreshortening the actual floral pedicel to such a point that subtending bracts have become associated with the flower in the position normally occupied by sepals in petaliferous flowers. That this is the case, rather than a single petaloid species among many apetalous species, is supported by the morphology of the inflorescence in the following species, *S. nitida* Don.

Sloanea jamaicensis is apparently a medium-sized to large tree in the mountain forest of Jamaica (see Map 10). In addition to being the only species of *Sloanea* found on Jamaica and the only species with "petals" in the New World, it is one of the largest-fruited species, its capsule being approached in size only by *S. dentata* of section *Sloanea*. It is commonly known as "break-ax" or "herring wood." Hooker states that Purdie found the aril flavorsome, and Patrick Browne reported that it is extensively eaten by birds.

JAMAICA: *Purdie s. n.* (Type-collection) (GH, S); John Crow Mts., *Harris* and *Britton 10760* (fl.) Mar. 10, 1909 (F, NY, US); Tyre, *Britton 582* (fr.) Sept. 13–18, 1906 (NY).

47. **Sloanea nitida** G. Don, Gen. Syst. **1:** 555. 1831.
S. bracteosa Ducke, Archiv. Instit. Biol. Veg. Rio de Janeiro **2:** 168. 1935.

Tree to 35 m. tall, trunk to 4 dm. in diameter, buttressed to 5 m. above the ground, "bark grey-brown, scaly, slash thin, brittle"—(*fide* For. Dept. Brit. Guiana). Twigs with brown, rough-striate bark, new growth striate, glabrate to finely puberulent. Leaves alternate; stipules to 3 mm. long, deltoid-lanceolate, puberulent, falling before the leaves develop; petioles 0.5–4.5 cm.

long, terete, striate, often with numerous transverse fissures, subincrassate at both ends, glabrous; blade 8–19.5 cm. long, 3.5–9.3 cm. wide, lanceolate-elliptic to elliptic to obovate, firmly chartaceous, midrib and secondary veins distinct to impressed, glabrous above, prominent, glabrous beneath, base acute to subcordate, apex subacute to obtuse to acuminate-obtuse, margin subentire to irregularly undulate. Inflorescences 5.5–7.5 cm. long, 1–5-flowered, primary peduncle 1.5–5 cm. long, substriate, angled, minutely to finely stramineous-puberulent, bracts persistent, 3–9 mm. long, 2–5 mm. wide, ovate to obovate, obtuse, margin entire to shallowly 3-lobed to irregular, densely stramineous-puberulent on the abaxial surface, finely and scantily puberulent on the adaxial surface, pedicels 1.5–2.5 cm. long, angled-striate, minutely to finely stramineous-puberulent, at times bearing a pair of large bracts shortly below the flower; flowers peach-color to rose with yellow stamens, about 8 mm. long, 12–15 mm. in diameter, sepals reflexed at anthesis 9–12 mm. long, 6–8 mm wide, densely, finely puberulent, often with a distinct margin without, minutely scattered-puberulent within; stamens 3–5 mm. long, the outermost staminodia with small anthers and fleshy, obclavate awns to 2 mm. long, filaments to 0.25 mm. long, glabrous, anthers 2.5–3.5 mm. long, lanceolate, generally truncate at the base, pubescent, opening by a lenticular pore at the apex, connective often deeply grooved on the adaxial side, prolonged into a glabrous awn 0.5–1 mm. long; pistil 6–8 mm. long, ovary 2.5–3 mm. long, to 2 mm. in diameter, ovoid, 4-loculed, more or less 4-angled, scarcely longitudinally striate, pubescent, style 4–5 mm. long, gradually tapered from the base, 4-angled, puberulent on the basal ½–⅔, glabrous above, apex entire, obtuse. Capsule 2.5–3 cm. long, to 2 cm. in diameter, broadly ellipsoidal, 4-loculed, 2–3-seeded, 4-valved; valves 2–5 mm. thick, surface densely shiny-pubescent, covered with wine-purple spines 1–2.5 cm. long; spines angled to terete, more or less tapered from the base, antrorsely scattered-pubescent. Seed (immature) ellipsoidal, almost entirely enveloped in an aril whose margin is probably irregular (specimens examined with aril partly decayed and/or broken).

Sloanea nitida Don is more closely related to *S. jamaicensis* than other American species of *Sloanea*. Reduction of the inflorescence has not been as complete as in the latter species, the peduncle being long, and generally more than one flower being borne on each peduncle. The presence of the large bracts on the pedicel just beneath the flower in the Ducke collection from Manáos is interesting as it provides a probable explanation for the "sepals" of *S. jamaicensis*. It can be seen that the large bracts immediately beneath the flower are at right angles to those subtending the pedicel. Although it is by no means a simple step, nor one that is apt to occur at all rapidly, the reduction of the pedicel so as to bring these two sets of bracts into the position of a calyx subtending a corolla is possible. Furthermore, the petal-like character of the sepals of *S. nitida* would require little change to become similar to the inner whorl of perianth parts in *S. jamaicensis*.

Sloanea nitida has, until now, been known only in the herbaria of Great Britain. None of the specimens which I have from

American herbaria bear the name *S. nitida.* Although it was described in 1831, this species has never been widely discussed in the literature. Because of the closeness with which Ducke's description and specimens fitted the short description given by Don, I asked that a check be made at the British Museum for a type-specimen. It proved to be a syntype of 3 sheets from the Lambert herbarium for which *S. bracteosa* Ducke is a synonym.

S. nitida is a species of the higher forest in the river-valleys in Guiana and the Amazon drainage. Its large size and probable scattered occurrence in mixed forest undoubtedly account for the small number of collections which have been made (see Map 3).

British Guiana: Moraballi Creek, Essequibo River, Forest Dept. field F-309, record 3045 (fl.) Nov. 16, 1939 (K). French Guiana: Cayenne, *Martin s. n.* (Type-Collection) (fr.) (K). Brazil: Pará: Belém, mata de Catú, *Ducke 1660* (fr.) Nov. 24, 1944 (A, BI, NY, RB, US). Amazonas: Manáos, Estrada do Aleixo, *Ducke* Herb. Jard. Bot. Rio de Janeiro 25115 (Type-collection, *S. bracteosa*) (fl. & fr.) Dec. 9, 1932 flor., Apr. 18, 1933 fruct. (S, US).

48. **Sloanea Kuhlmannii** Ducke, Archiv. Instit. Biol. Veg. Rio de Janeiro **2:** 160. 1935.

Twigs moderately stout, bark brown, scarcely striate, lenticels lenticular, light in color, new growth scarcely striate, golden-brown-pubescent. Leaves subopposite; stipules present only before the leaf develops; petioles to 2.3 cm. long, terete, tawny-pubescent; blade to 14 cm. long, 6.4 cm. wide, elliptical, chartaceous, midrib and secondary veins distinct, tawny-pubescent above, prominent, dark in color, often scattered-pubescent beneath, base obtuse, apex obtuse to emarginate, margin irregularly repand-serrate. Inflorescences to 4 cm. long, generally 3-flowered, peduncle to 2.3 cm. long, subterete, scattered-tawny-pubescent, pedicels to 1 cm. long, tawny-pubescent, sepals reflexed at anthesis to 7 mm. long, 3–6 mm. wide, lanceolate-ovate to ovate, tawny-puberulent without, veins distinct, scattered-tawny-puberulent except on the margin within; receptacle with a distinct corrugated margin; stamens 4.5–6 mm. long, filaments 0.5–2.5 mm. long, tawny- pubescent, anthers 1.5–2 mm. long, lanceolate, cordate at the base, minutely puberulent, dehiscing by a large lenticular or oval pore, connective often moderately wide, dark in color, prolonged into a minutely puberulent awn 0.5–1 mm. long; pistil to 8 mm. long, ovary to 2 mm. long, 1 mm. in diameter, ovoid, 4-loculed, tawny-pubescent, style to 4 mm. long, slender, puberulent at the base, glabrous above, at times contorted. Capsules not seen.

Sloanea Kuhlmannii Ducke is a distinct species of the Amazon basin (see Map 3). It differs from *S. nitida* in the longer filaments, the almost glabrous slender style, and the lack of persistent bracts in the inflorescence.

Brazil: Amazonas: Boa Vista, Rio Branco super, Herb. Jard. Bot. Rio de Janeiro 3667 *J. G. Kuhlmann* (Type-collection) (fl.) Oct. 1913 (US); Rio Negro; Upper Jurubaxí River, *R. L. Fróes 23307* (fr. immature) July 4, 1948 (GH).

49. **Sloanea erismoides** Ducke, Archiv. Instit. Biol. Veg. Rio de Janeiro **2:** 164. 1935.

Medium-sized tree (*fide* Ducke). Twigs gray, striate, nodes more or less enlarged. Leaves opposite; petioles 2–4 mm. long, subcanaliculate above, glabrous; blade to 25.5 cm. long (apex broken), 9 cm. wide, elongate-elliptical, chartaceous, midrib prominent, dark in color above and below, secondary veins distinct, light in color, glabrous above, and below; base rounded, apex acuminate, obtuse, margin irregularly subundulate. Inflorescences to 8 cm. long, racemose, peduncle to 7 cm. long, finely striate, glabrate, pedicels 1–2 cm. long, finely striate, enlarged abruptly at the apex, minutely scattered-puberulent; flowers (past anthesis) to 8 mm. long, sepals 5–6 mm. long, 1.5–2 mm. wide, lanceolate-ovate to ovate-acuminate, minutely puberulent within and without; stamens to 4 mm. long, filaments to 2 mm. long, very finely puberulent, anthers to 2 mm. long, elliptical, subpuberulent, dehiscing by a line over the apical ⅗, connective continued into a short, stout, obtuse awn; pistil to 7 mm. long, ovary to 3 mm. long, 2 mm. in diameter, ellipsoidal, 4-loculed, minutely puberulent, style to 4 mm. long, glabrous above the base, apex prominently 4-parted. Capsule rose-purple, aril red (*fide* Ducke), to 1.5 cm. long, 1.3 cm. in diameter, 4-valved; valves to 2 mm. thick, woody, surface finely verrucose, very finely puberulent, densely covered with irritant spines; spines 0.5–0.7 mm. long, clavate, hispid with antrorse, flattened trichomes. Seed not sufficiently mature for diagnosis.

Sloanea erismoides Ducke is a distinct species which seems to be related to *S. Kuhlmannii*, but differing from it and the following species in the short petioles, the prominently parted style, and the short-awned stamens. However, *S. erismoides* shares with *S. porphyrocarpa* the following characters: opposite elliptical leaves with almost identical venation, very similar racemose inflorescences, reflexed receptacle, indument of the ovary very short, linear dehiscence of the stamens, and similar fruit and aril color. Future collections of these species may prove that they are not distinct from one another.

S. erismoides has been collected only in Pará, Brazil (see Map 10).

Brazil: Pará: Santarem, silva Ipanema, *Ducke* Herb. Jard. Bot. Rio de Janeiro 18382 (fl. past anthesis) Sept. 6, 1923 (US); Alto Tapajos, Vila Nova, perto da Cachoeira do Chacarao, *Pires 4000* (fr.) Jan. 22, 1952 (GH).

50. **Sloanea porphyrocarpa** Ducke, Archiv. Instit. Biol. Veg. Rio de Janeiro **2:** 167. 1935.

Medium-sized tree. Twigs moderately stout, gray-brown, substriate, at times rugose, new growth striate, minutely puberulent to puberulent, lenticels elongate, light in color. Leaves opposite to alternate; petioles 0.5–4 cm. long, striate, puberulent, more or less incrassate at both ends; blades 8.5–21 cm. long, 3–7 cm. wide, elliptical to obovate, chartaceous, midrib and secondary veins distinct, glabrate to puberulent above, prominent, glabrate to scattered-puberulent beneath, base obtuse to abruptly rounded, apex obtuse to acumi-

nate-obtuse to acuminate-mucronulate, margin irregularly subundulate, at times revolute. Inflorescences 3.5–5.5 cm. long, racemose, peduncles 1.5–4 cm. long, substriate, minutely puberulent, pedicels 0.7–1.7 cm. long, striate, minutely puberulent; flowers green, fragrant, (past anthesis) recurved, 7 mm. long, 4 mm. in diameter, sepals to 5 mm. long, to 3 mm. wide at the base, deltoid, acuminate-obtuse, minutely puberulent on both surfaces; receptacle recurved at the margin, occasionally with a narrow entire rim; stamens 2.5–3 mm. long, filaments 0.5 mm. long, puberulent, anthers 0.75–1.25 mm. long, oval, puberulent, opening by a line, connective prolonged into an awn 0.3–0.5 mm. long, puberulent; pistil to 5 mm. long, ovary 2 mm. long, 2 mm. in diameter, subglobose, 4–5-angled, 4–5-loculed, finely verrucose, minutely puberulent, style to 3 mm. long, minutely puberulent on the basal ⅔, glabrous above, entire, obtuse. Capsule 2.5–3 cm. long, probably about 2 cm. in diameter, ellipsoidal, 1-seeded, 4–6-valved; valves 2–3 mm. thick, surface finely verruculose, minutely puberulent, densely covered with fine, easily detached spines; spines dark-purple (*fide* Ducke) to 2 mm. long, clavate, scattered-ascending-puberulent, often tipped with 1 to several simple trichomes. Seed to 1.5 cm. long, 1.2 cm. in diameter, subglobose, almost entirely covered with a 4-lobed aril, margin of the aril-lobes irregular; aril red, sweet, fragrant (*fide* Ducke).

Sloanea porphyrocarpa Ducke is distinguished from the preceding species by the short filaments, the verruculose ovary, and by the armed fruit. In many characters it shows its relationship to the following species of *Sloanea*. Of somewhat more restricted range than most of the species in the genus, *S. porphyrocarpa* grows in the river bottoms or on the higher land nearby in Pará, Brazil (see Map 5).

Brazil: Pará: Rio Cuminá, mirim affl. Rio Trombetes infer., *Ducke* Herb. Jard. Bot. Rio de Janeiro 20970 (fl.) Nov. 28, 1910 (US); Belém, Bosque Municipal, *Ducke 2034* (fr.) Dec. 4, 1946 (A, GH, NY, US); Rio Cuparí, Ingatuba, *Black 47-2081* (fl.) Dec. 28, 1947 (GH, NY, VEN).

51. **Sloanea Garckeana** Schumann in Mart., Flor. Bras. **12** (3): 177, tab. 36. 1886.

S. reticulata A. C. Smith, Bull. Torr. Bot. Club **61:** 194. 1934. In part.

Tree to 15 m. tall (*fide* Krukoff). Twigs with rough, light-brown bark, new growth glabrate to, usually, densely pubescent. Leaves alternate to subopposite; petiole 0.5–2.8 cm. long, subterete, striate, minutely puberulent to densely pubescent; blade 8–21.5 cm. long, 3–7.5 cm. wide, elliptical to obovate, membranaceous to chartaceous, midrib and secondary veins subimpressed, glabrous to puberulent above, prominent, glabrate to pubescent and scattered-hirsute beneath, reticulation fine, distinct on both surfaces, base subacute to abruptly obtuse, apex acuminate, acute to obtuse, at times mucronulate, margin irregularly subundulate to repand-dentate, particularly toward the apex. Inflorescences 4–9 cm. long, umbellately 2–5-flowered, peduncle 2–6.5 cm. long, minutely to finely puberulent and scattered to densely hirsute, pedicels 1.3–2.8 cm. long, substriate, minutely puberulent and scattered to

densely hirsute, bracts, if present, to 3 mm. long, linear, pubescent; buds ovoid; flowers pale-green with scarlet disc (*fide* Forest Dept. Brit. Guiana), 6–8 mm. long, 6–8 mm. in diameter, sepals 6–7 mm. long, 2–4 mm. wide, lanceolate-ovate to ovate, acuminate, puberulent and often scattered-hirsute without and within, particularly along the margin; stamens 3.5–4 mm. long, filaments 0.75–2 mm. long, pubescent, anthers 1–1.5 mm. long, lanceolate to deltoid-lanceolate, base truncate, short-pubescent, dehiscing by a lenticular pore at the apex, connective moderately wide, dark in color, puberulent, prolonged into a subulate, sparsely pubescent to glabrous awn 1–2 mm. long; pistil 4–6 mm. long, ovary about 2 mm. long, 1.5 mm. in diameter, 4-loculed, densely long-golden-pubescent, style 2–4 mm. long, contorted, pubescent at the base, glabrous above, apex entire. Capsule 2.5–3.5 cm. long, ellipsoidal, 1–2-seeded, 4-valved; valves 1.5–3 mm. thick, surface velutinous, densely covered with fine spines; spines scarcely clavate, 2 mm. long, antrorsely short-pubescent. Seed about 12 mm. long, 7 mm. in diameter, subellipsoidal, covered almost entirely by an irregular-margined orange aril.

Sloanea Garckeana Schum. is closely related to the other species in this group, but it is easily differentiated by the very long staminal awn, the golden long-pubescent ovary and the twisted style. The yellowish fruit-spines and the orange aril are distinctive in the collections which I have seen, but, as there is little known about variation in fruit color in this group, identifications based on floral material are more satisfactory.

A. C. Smith cited, with his description of *S. reticulata*, Krukoff specimens which more closely agree with *S. Garckeana* than with any other species. Thus, *S. reticulata* is, in part, synonymous with *S. Garckeana*.

Sloanea Garckeana is apparently an understory tree of the higher land in the Guianas and the Amazon area of Brazil as well as an extension southward along the Atlantic coast (see Map 5).

British Guiana: Mazaruni Station: Forest Dept. field F-508, record 3244 (fl.) July 4, 1940 (K); Forest Dept. field F-110, record 2709 (fr.) Aug. 31, 1938 (K). Brazil: Pará: Igarapé Remansinho, Rio Tocantins, *Fróes 23400* (fl. past anthesis) Sept. 6, 1948 (GH). Territory of Acre: Basin of Rio Purus, near mouth of Rio Macauhan (tributary of Rio Yaco), *Krukoff 5548* (fl. past anthesis) Aug., 1933 (A, F, G, K, NY, S, US); Basin of Rio Jurua, upper Rio Yurupary, *Krukoff 5230* (fl.) July 15, 1933 (A, F, MO, NY, S, US). Maranhão: São Luiz, Granja Barreto, *Fróes 24282* (fr.) May 14, 1949 (BI). Rio de Janeiro: *Riedel 888* (Type-collection) (fl.) Sept., Oct., 1832 (L, US); Chacara do Fonseca, *Occhioni* Herb. Jard. Bot. Rio de Janeiro 4334 (fl.) Dec. 9, 1921 (S, US). Pernambuco: Recife prox. a Ouro Prieto, *Leal* and *Silva 161* Herb. Jard. Bot. Rio de Janeiro 70908 (fr.) June 27, 1950 (BI, RB).

52. **Sloanea terniflora** (Moc. and Sessé) Standl., Tropical Woods **79:** 10. 1944.

Lecostemon terniflorum Moc. and Sessé ex DeCandolle, Prodr. **2:** 639. 1825.

Lasiocarpus triflorus Oersted, Vidensk. Medd. 1853. Oversigt. 26 de Mai 1852. Nomen nudum.
Sloanea quadrivalvis Seemann, Bot. Voy. Herald 85, tab. 15. 1853.
Dasycarpus quadrivalvis Oersted, Vidensk. Medd. 1855. 27. 1857.
Sloanea xylocarpa Rusby, Mem. N. Y. Bot. Gard. **7:** 294. 1927. In part.
Sloanea reticulata A. C. Smith, Bull. Torr. Bot. Club **61:** 194. 1934. In part.

Tree to 30 m. high (*fide* Maxon and Harvey), trunk buttressed, bark smooth, black (*fide* Schultes). Twigs with brown or gray-brown, finely striate, often rugose bark, new growth striate, minutely scattered-puberulent to puberulent. Leaves alternate to opposite; petioles 0.3–2 cm. long, subterete, striate, minutely scattered-puberulent to puberulent, often with a puberulent line on the upper side; blade 6.5–15 cm. long, 3–7.5 cm. wide, subovate to elliptical to obovate, firmly chartaceous to coriaceous, midrib and secondary veins distinct to prominent, glabrous to puberulent above, prominent, glabrous to puberulent beneath, often light in color, base subcordate to rounded to cuneate-obtuse, apex rounded to obtuse to acuminate-obtuse; margin entire to irregularly undulate to irregularly repand-dentate particularly toward the apex. Inflorescences 3.5–5.5 cm. long, umbellately 1–3-flowered, peduncles 1.5–3 cm. long, striate, often laterally flattened, glabrous to finely puberulent, pedicels 0.8–1.3 cm. long, striate, glabrous to finely puberulent; flowers maroon with pale-yellow stamens (*fide* Allen), 5–7 mm. long, 6–8 mm. in diameter, sepals 6–7 mm. long, 2–5 mm. wide, ovate, at times acuminate, minutely to finely scattered-puberulent without and within, margins densely puberulent; stamens 3–4.5 mm. long, filaments 0.5–1 mm. long, finely puberulent to puberulent, anthers 1–2.5 mm. long, elliptical to deltoid-lanceolate, finely puberulent to puberulent, opening by a lenticular pore at the apex, connective prolonged into a finely puberulent to puberulent awn 0.5–1 mm. long; pistil 4–5 mm. long, ovary 2–2.5 mm. long, about 1.5 mm. in diameter, ovoid, usually 4-loculed, puberulent to pubescent, style 2–2.5 mm. long, puberulent on the basal ⅓, glabrous above, apex entire. Capsule 1.5–2.5 cm. long, ellipsoidal, 1–2-seeded, 4-valved; valves 1–3 mm. thick, densely covered with easily detached spines; spines about 2 mm. long, clavate, puberulent with antrorse flattened trichomes, apex often with several longer trichomes. Seed 1–1.2 cm. long, 0.5–0.6 cm. in diameter, ellipsoidal, almost entirely covered with an irregular-margined aril firmly attached to the chalazal ¼ of the seed.

Sloanea terniflora (Moc. & Sessé) Standl. is a widely distributed tree of the American tropics closely related to *S. Garckeana* of South America. It is a polymorphic species whose forms intergrade; it is possible to distinguish regional foliar variations, but it is impossible to separate the flowers and fruit.

The species was first collected in Mexico and described by Mociño and Sessé as *Lecostemon terniflorum* in DeCandolle's Prodromus. It was again collected and described by Berthold Seemann from Panama. Seemann's name, *Sloanea quadrivalvis*, became the epithet generally applied to the species in Central

America. In 1857, Oersted placed the species in *Dasycarpus* on the basis of his collections from Nicaragua and Costa Rica, although he had provisionally named a Costa Rican collection as *Lasiocarpus triflorus* and displayed it so named at the Society of Natural History in Copenhagen, hence the publication of the name without a description. On the basis of recent Krukoff collections from Brazil, A. C. Smith renamed the species *S. reticulata*. Smith pointed out its close relationship with *S. Garckeana*. It was not until the 1940's that Standley rediscovered the earliest name applied to the species, *Lecostemon terniflorum*, and made the nomenclatural transfer to the genus *Sloanea*. Inasmuch as I have seen original material of all of the names involved, there is no doubt that they are one and the same species.

Throughout Central America, *S. terniflora* is common both as a forest tree, and as a relic in clearings and pastures. In Mexico, it is commonly called "mosco" in allusion to the spines, or "huesillo" or "caquito." From Guatemala southward it is usually called "terciopelo" because of the capsular spines. It is also known as "ocote" in Nicuaragua and "casaco" in Panama. "Urucúrana" is the name usually applied to *Sloanea* in Brazil. Mexia reports that the Peruvians call the tree "anallocaspi" or ant tree.

S. terniflora is distributed from Nayarit, west central Mexico on the Pacific coast, throughout Central America, southward into Colombia, Peru and Bolivia and eastward to the Atlantic coast of Brazil as far south as Maranhão (see Map 10).

MEXICO: Nova Hispania, *Sessé* and *Mociño 2284* (Type-collection, *Lecostemon terniflorum*) 1787–1804 (F (fragments)); NAYARIT: San Blas, *C. D. Mell 542* (fl. & fr.) Apr. 13, 1930 (NY, US). CHIAPAS: Ulapa, *E. Matuda 1998* (fr. immature) Jan., 1938 (A, K, NY, US). GUATEMALA: ESQUINTLA: *J. D. Smith 1975* (fr.) Mar., 1890 (GH, US). QUETZALTENANGO: Río Ocosito, *J. D. Smith 1473* (fr.) Apr., 1892 (GH, PH). SANTA ROSA: Along the Avellana road south of Guayacapán, *Standley 79469* (fl. & fr.) Dec. 6, 1940 (F, US). JUTIAPA: Near Mongoy, *L. O. Williams 14206* (fr.) May 12, 1948 (F). ALTA VERAPAZ: Along Río Semococh between Semococh and Chajamyic, *Steyermark 45133* (fr. immature) Apr. 17, 1942 (F). EL SALVADOR: Near Cahlahuapa, *Calderón 963* (fr.) 1922 (GH, US). NICARAGUA: Granada, *Oersted 14833* (fl.) Feb., 1848 (F, GH, US): Inter Granada et Nicaragua, *Oersted 501* (fl. past anthesis) Feb., 1848 (US); Zelaya, entre Río Grand y Wenkalaya, *Molina 2201* (fl.) Apr. 13, 1949 (F), COSTA RICA: GUANACASTE: Ad Hacienda Santa Rosa, *Oersted 500* (fl.) Mar., 1847 (US); Bebedero, *Standley* and *Valerio 46681* (fr. immature) Feb. 3, 1926 (US). ALAJUELA: Vicinity of Los Chiles, Río Frio, *Holm* and *Iltis 685* (fl. & fr.) Aug. 1, 1949 (GH, MO). NICOYA: El Rodeo, *Lankester 1330* (fl.) Feb., 1931 (F, S). PANAMA: CANAL ZONE: Chivi-chivi Trail, 2 miles above Red Tank, *Maxon* and *Harvey 6585* (fr.) May 28, 1923 (GH, NY, US); Río Agua

Salud near Frijoles, *Piper 5863* (fl. past anthesis) Mar. 6, 1923 (US). CHIRIQUI: Vicinity of David, *Pittier 2833* (fr. immature) Feb. 27, 1911 (US). PANAMA: Between Matías Hernandez and Juan Díaz, *Standley 31959* (fr. immature) Jan. 21, 1924 (A, US); Forests of Juan Díaz near Panama City, *Pittier 2557* (fl.) Jan. 25, 1911 (F, GH, NY, US). COCLÉ: Valley of the upper Río Mata Ahogada, *Allen 144* (fl.) Dec. 31, 1936 (A, F, GH); Veraguas, *Seemann s. n.* (Type-collection, *S. quadrivalvis*) (fl.) 1849 (GH). COLOMBIA: AMAZONAS: Trapecio Amazónico Loretoyacu River, *Schultes 6827* (fr. immature) Oct., 1945 (US). BRAZIL: PARÁ: Rio Yamanchin, *E. Snethlage 10094* (fl.) Sept. 28, 1908 (F); Caminho de Jubim para Condeixa, Ilha do Marajó, *Black 48-3557* (fl. past anthesis) Nov. 14, 1948 (GH). AMAZONAS: Camatian, *Fróes 23970* (fr. immature) Jan. 24, 1949 (GH); Curuça, *T. N. Guedes 36* (fl. & fr.) Dec. 26, 1947 (GH). MARANHÃO: Maracassumé River region, *Fróes 1918* (Type-collection, *S. reticulata*) (fl.) Sept. 16, 1932 (A, F, MO, NY, S, US); São Luis, Granja Barreto, *Ducke 2177* (fl.) Oct. 29, 1948 (GH). PERU: LORETO: Above Iquitos, Río Marañon, *Mexia 6510* (fr. immature) Feb. 9, 1932 (F, GH, MO, NY, PH, S, US). BOLIVIA: Tumapasa, *Cárdenas 1969* (fr.) Dec. 9, 1921 (GH, US).

53. **Sloanea amygdalina** Grisebach, Mem. Amer. Acad. n. s. **8:** 165. 1862.
S. domingensis Urban in Fedde, Rep. Spec. Nov. **16:** 140. 1919.

Large tree. Twigs gray to brown, substriate, new growth striate, densely puberulent to scattered-pubescent. Leaves alternate, crowded toward the ends of the twigs; petioles 0.5–2.5 cm. long, terete or scarcely canaliculate above, subincrassate at the apex, glabrate to scattered-puberulent; blade 5.5–15 cm. long, 2.5–11 cm. wide, elliptical to broadly oval, midrib and secondary veins distinct, glabrous to puberulent above, prominent, glabrous to puberulent beneath, base subacute to usually rounded to cordate, apex obtuse to emarginate, margin almost entire to irregularly undulate. Inflorescences umbellately 1–3-flowered, 3–6.5 cm. long, peduncles 1.5–5 cm. long, often tapered upward to the apex, glabrous to scattered-puberulent, pedicels 0.5–1.5 cm. long, scattered-puberulent; flowers 6–12 mm. long, 5–8 mm. in diameter, sepals 3–11 mm. long, 2–6 mm. wide, ovate, glabrous to finely scattered-puberulent without, scattered to densely puberulent within, particularly along the margins: receptacle reflexed, usually with an irregularly corrugate rim; stamens to 5.5 mm. long, filaments 1–1.5 mm. long, puberulent, anthers 1.5–3 mm. long, linear-deltoid, truncate at the base, finely puberulent, opening by a lenticular pore at the apex, connective prolonged into a glabrate to puberulent awn to 1 mm. long; pistil 3–6 mm. long, ovary 2–3 mm. long, 2–3 mm. in diameter, ovoid, 4–5-loculed, densely pubescent, style 1.5–2 mm. long, glabrous except at the base, apex entire. Capsule brown, 1.5–2.5 cm. long, 1.3–2 cm. in diameter, subglobose, usually 4-valved; valves to 2.5 mm. thick, densely covered with easily detached spines 1–1.5 mm. long; spines antrorsely puberulent with several longer trichomes at the apex. Seed not seen.

Sloanea amydalina Gris. is a tree of calcareous soils in the higher land of Cuba and Hispaniola (see Map 10). Closely related to *S. terniflora*, it is distinguished by the leaves clustered toward the ends of the twigs, the prevalently single-flowered inflorescences and the short spines of the capsule. The collections from Cuba are usually smaller overall than those from

Hispaniola, but I can find no difference of sufficient value to keep the two groups as separate species. Therefore, *S. domingensis* becomes a synonym of *S. amygdalina.*

Cuba: Pinar del Rio: Hills north of San Cristobal, *A. Fors 4363* (fr.) May, 1927 (NY); Cayo Largo, *M. Aubel 5640* (fl. past anthesis) May 31, 1931 (NY); Oriente: Bayate: Ad Paso Estancia, *Ekman 6271* (fl. past anthesis) July 27, 1915 (S); *Ekman 6242* (fr. immature) July 18, 1915 (S); Prope Monte Verde, Retiro, *Wright 1119* (Type-collection) (fl. & fr. immature) June 28, 1859 (GH, MO, NY, S). Hispaniola: Haiti: Massif de La Selle, Petionville: *Ekman H-2352* (fr.) Nov. 2, 1924 (S, US); Source Dieque, *Ekman H-8123* (fl. past anthesis) May 12, 1927 (S, US). Dominican Republic: Macoris: W. of San Pedro de Macoris, *R. A.* and *E. S. Howard 9466* (fr.) Oct. 18, 1946 (GH): Samaná: Laguna, rocky ridge N. of Pan de Azucar, *Ekman H-15094* (fl. past anthesis) May 25, 1930 (S, US). Puerto Rico: Maircoo Insular Forest, *G. A, Gerhart 601* (fr.) July 26, 1935 (NY); *Mociño s. n.* (probably Sessé) (G).

54. **Sloanea grandis** Ducke, Archiv. Instit. Biol. Veg. Rio de Janeiro **2:** 163. 1935.

Tree. Twigs brown, striate, short-puberulent. Leaves alternate; petioles 3–7.5 cm. long, subcanaliculate above, finely striate, minutely puberulent; blade 14–28 cm. long, 7–14.5 cm. wide, obovate, midrib and secondary veins puberulent above, prominent, puberulent beneath, base subacute to subcordate, (in *Fróes 20362*, often auriculate), apex short-acuminate-obtuse, margin irregularly undulate. Inflorescences corymbo-racemose, peduncles 3.5–10.5 cm. long, angled-striate, puberulent, pedicels 8–17 mm. long, finely striate, puberulent; flowers 4–6 mm. long, about 7 mm. in diameter, sepals 3–6 mm. long, 2–3 mm. wide, ovate, obtuse to acuminate-obtuse, densely puberulent within and without; receptacle reflexed, margin without rim, often irregular; stamens 3–4 mm. long, filaments 0.3–2 mm. long, puberulent, anthers 1–1.5 mm. long, linear, truncate at the base, opening throughout their length, minutely puberulent, connective prolonged into a short partly puberulent awn; pistil 4–6 mm. long, ovary 1.5–2 mm. long, 2 mm. in diameter, subglobose, 4-loculed, densely puberulent, style 2–4 mm. long, at times contorted, glabrous, apex entire. Capsule to 3 cm. long, ellipsoidal (?), 4-valved; valves to 1 mm. thick, covered with flexible spines which are antrorsely pubescent.

Sloanea grandis Ducke, although related to *S. terniflora* and *S. amygdalina,* does not have the small irritant spines on the capsule. Although the flower of the former is very similar to that of the last-named species, it differs in the linear dehiscence of the anthers, and in the short awn. Little can be said concerning the distribution of this species as it has only been infrequently collected in Pará, Brazil (see Map 10). The type-collection of *S. grandis* (Herb. Jard. Bot. Rio de Janeiro 18375) consists of only a single leaf and inflorescence. However, the species is adequately validated by *Fróes 20362* which is a twig with abundant leaves and flowers.

BRAZIL: PARÁ: Estrada de Ferro de Bragança, Capanema, *Fróes 20362* (fl. past anthesis) Jan. 16, 1945 (BI, NY); Obidos, *Ducke* Herb. Jard. Bot. Rio de Janeiro 20965 (fr.) Dec. 22, 1907 (RB); Bragança, *Ducke* Herb. Jard. Bot. Rio de Janeiro 18375 (Type-collection) (fl.) Jan. 7, 1923 (RB).

55. **Sloanea monosperma** Vellozo, Fl. Fl. text. 225. 1825. **5:** tab. 100. 1827.

Dasynema hirsutum Schott in Spreng., Syst. Veg. **4:** Cur. Post. 408. 1827.

Sloanea hirsuta (Schott) Planch. ex Benth., Journ. Linn. Soc. **5:** suppl. 70. 1861.

Adenobasium salicifolium Presl, Symb. Bot. **1:** 40, tab. 27. 1832.

Dasynema salicifolium (Presl) Endl. ex Walp., Report **1:** 352. 1842.

Dasynema riparium Gardn. in Hook., Lond. Journ. Bot. **2:** 334. 1843.

Sloanea riparia (Gardn.) Planch. ex Benth., Journ. Linn. Soc. **5:** suppl. 69. 1861.

Dasynema ochrocarpum Mart., in Benth. Journ. Linn. Soc. **5:** Suppl. 70. 1861. In synon.

Sloanea ochrocarpa (Mart.) Radlk., Sitzungsber. Math.-Phys. Akad. Muench. **12:** 329. 1882.

S. pulverulenta Radlk., Sitzungsber. Math.-Phys. Acad. Muench. **12:** 329. 1882.

S. monosperma var. *pulverulenta* (Radlk.) Schum. in Mart., Fl. Bras. **12** (13): 186. 1886.

S. monsperma var. *hirsutissima* Schum. in Mart., Fl. Bras. **12** (3): 186. 1886.

S. monosperma var. *virgata* Schum. in Mart., Fl. Bras. **12** (3): 186. 1886.

S. monosperma var. *coriacea* Schum. in Mart., Fl. Bras. **12** (3): 186. 1886.

S. monosperma var. *ovalis* Schum. in Mart., Fl. Bras. **12** (3): 186. 1886.

Tree to 8 m. (*fide* Mexia). Twigs with gray-brown, often rough, finely striate bark, new growth striate, glabrate to minutely puberulent to puberulent, Leaves opposite to subopposite, stipules caducous before leaf develops, linear, puberulent; petioles 0.3–2 cm. long, striate, glabrous to finely puberulent to pubescent; blades 6–11.5 cm. long, 2–5 cm. wide, lanceolate-elliptical to elliptical to obovate, midrib and secondary veins subimpressed, glabrate to puberulent above, prominent, glabrate to puberulent beneath, at times secondary veins barbate in the axils, base acute to obtuse, apex obtuse to acuminate-obtuse to acuminate-acute, margin entire. Inflorescences 0.8–2.5 cm. long, 1–3-flowered, peduncles 3–6 mm. long, striate, finely puberulent, pedicels 6–12 mm. long, slender, more or less striate, finely puberulent, bracts, if present, to 0.75 mm. long, deltoid-lanceolate, puberulent; flowers about 3 mm. long, 5–8 mm. in diameter, sepals rarely 5, 3–4 mm. long, 2–4 mm. wide, deltoid to ovate, puberulent at the margins, otherwise glabrate to minutely puberulent without, minutely puberulent within; stamens 1.5–3 mm. long, filaments 0.5–1.5 mm. long, puberulent, anthers 1–1.5 mm. long, ovate, minutely puberulent, dehisc-

ing by a pore at the apex, connective prolonged into a knob or very short awn; pistil 1.5–2.5 mm. long, ovary 0.5–1 mm. long, 0.5–0.75 mm. in diameter, subglobose to ovoid, usually 4-loculed, finely puberulent, style about 1 mm. long, glabrous except at the base, generally 4-parted at the apex. Capsule 1.5–3 cm. long, ellipsoidal, usually 1-seeded, 4-valved; valves 1–3 mm. thick, surface finely puberulent and densely covered with easily detached spines; spines 1–7 mm. long, clavate to slenderly clavate, antrorsely scattered-pubescent with shining flattened trichomes, apex often with one to several longer trichomes. Seed to 9 mm. long, about 3 mm. in diameter, ellipsoidal, almost entirely covered by a 3-lobed aril firmly attached to the chalazal ¼ of the seed; margin of the aril irregular.

Sloanea monosperma Vell. is an extremely variable species which has been divided up into a number of species and varieties and even genera. Although Vellozo's description is meager, there is no doubt as to the identity of the plant illustrated. In the same year that Vellozo's plate was published, *Dasynema hirsutum* was published by Sprengel. From the description, this plant is conspecific with that of Vellozo. The recombination made by Bentham in 1861 brought the epithet *hirsuta* into *Sloanea*. I have not seen *Gardner 5374* which Bentham cites, although several other collections seen from Tejuca, Rio de Janeiro, are all *S. monosperma*. The plate of *Adenobasium salicifolium* Presl, based on a sheet in his herbarium, is, beyond doubt, the same as *S. monosperma*. Although this name was transferred to *Dasynema* by Walpers, it never was brought into *Sloanea*. In 1843 Gardner published *Dasynema riparium* as a distinct species on the basis of his collections from the Serra dos Organos in which the inflorescences are longer than those illustrated by Vellozo. In other characters, the two species are identical, and I have seen inflorescences intermediate in length between the two extremes, so I am reducing to synonymy *S. riparia* (Gardn.) Benth. Bentham published *Dasynema ochrocarpum* in 1861 in synonymy based on Martius' herbarium-number 831 (which is apparently *Claussen 165* from Minas Geraes). A fragment of this in the Chicago Natural History Museum, and the photograph of material of this number are the same as *S. monosperma*. This name had been transferred to *Sloanea* by Radlkofer in 1881. However, Martius herb. 831 is apparently a mixed collection, as this label from the New York Botanical Garden applies to a sterile specimen which agrees in detail with Schumann's description of *S. monosperma* var. *hirsutissma*. This latter I am provisionally including in the synonymy of *S. monosperma* pending further observations on fertile material with similar foliage. Finally, Schumann published in Martius' Flora

Brasiliensis a series of varieties of *S. monosperma*, only one of which was a nomenclatural transfer. *S. pulverulenta* Radlk. (*S. monosperma* var *pulverulenta* (Radlk.) Schum.) and the Schumann varieties *virgata*, *coriacea*, and *ovalis* are based primarily on foliar characters. As I can distinguish two or more of the varieties in the foliage of almost any collection of *S. monosperma*, I am reducing all of the varieties into the species.

Sloanea monosperma is closely related to *S. terniflora* as can be seen in many of the features of the flowers and fruit. It differs from the latter species in the parted style, the knob or short awn above the anthers, and in the deeply 3-lobed aril on the seed. The inflorescences of *S. terniflora* are generally much longer, and bear 3 or more flowers, while the short inflorescences of *S. monosperma* often bear only one flower.

S. monosperma has been collected further south in Brazil than most species of *Sloanea*. It does not appear to grow northward in the Amazon basin (see Map 5). Habitat-notes are very scanty on old collections, but this species is apparently a forest-tree of hilly areas which may persist in partially cleared land.

BRAZIL: RIO DE JANEIRO: Distrito Federal, *Pereira 595* Herb. Jard. Bot. Rio de Janeiro 63181 (fl.) 1947 (RB); Tejuco, *Pohl (Schott) 5909* (fl.) (GH); Serra dos Organos, *Gardner 327* (Type-collection, *Dasynema riparium*) (fl.) Feb., 1837 (F, G, GH, NY, S, US); Alto Macabé, *Glaziou 17468* (fl.) Dec. 10, 1888, Feb. 3, 1889 (F, GH, NY, US); *Sellow 539* (Type-collection, var. *pulverulenta*) (fr.) (US). MINAS GERAES: *Martius 831* (Type-collection, *Dasynema ochrocarpum*) *Claussen 165* fide Schumann) (fl.) 1841 (F, L, NY (see discussion)); *Claussen 165* (fl.) (F). SÃO PAULO: Santos, Lororocaba, *Mosén 32784* (Type-collection, var. *ovalis*) (fr.) Dec. 15, 1874 (S). PARANÁ: Marrates, *Dusén 14389* (fl. & fr.) Jan. 23, 1914 (GH, MO, S). RIO GRANDE DO SUL: Canela, *Häusler 34175* (fl.) Oct. 10, 1946 (MO). BRAZIL WITHOUT LOCALITY: *Sello 233* (Type-collection, var. *coriacea* ?) (fr.) (F); *Riedel s. n.* (Type-collection, var *virgata* ?) (fl.) Feb., Mar., 1823 (L).

56. **Sloanea lasiocoma** Schumann in Mart., Fl. Bras. **12** (3): 184. 1886.

Tree 15–20 m. tall (*fide* Hatschbach). Twigs with gray-brown often rough bark, new growth substriate, glabrous to scattered-puberulent. Leaves opposite to alternate, stipules linear, puberulent, caducous before the leaf matures; petioles 3–17 mm. long, canaliculate above, glabrous to puberulent; blade 3.5–7.5 cm. long, 2.2–3.5 cm. wide, oval to elliptical to obovate, coriaceous, nitid above, midrib and secondary veins subimpressed to distinct, glabrous above, prominent, glabrous to scattered-puberulent beneath, secondary veins occasionally barbate in the axils, base subacute to rounded, apex emarginate to rounded, margin entire, often revolute. Inflorescences 10–15 mm. long, single-flowered, pedicel 7–11 mm. long, slender, striate, minutely scattered-puberulent; flowers yellowish-white to green, 3–7 mm. long, 7–12 mm. in diameter, sepals 4–8 mm. long, 1.5–3.5 mm. wide, ovate, scarcely finely

puberulent without, finely puberulent within, densely so on the margins, stamens 3–4 mm. long, filaments 1–2 mm. long, puberulent, anthers 1–1.5 mm. long, elliptical to obovate, finely puberulent, dehiscing at the apex, or almost their entire length, connective prolonged into a short, stout, finely puberulent awn; pistil 4–6 mm. long, ovary 1.25–1.75 mm. long, about 1 mm. in diameter, subglobose to ellipsoidal, 4-angled, 4-loculed, finely puberulent to scarcely finely puberulent, apex 4-parted, capsule (immature) to about 1.5 cm. long, subglobose, 1–2-seeded, 4-valved; valves densely covered with spines to 7 mm. long; spines antrorsely hispid, the trichomes flattened, shining. Seed (immature) almost entirely covered with an irregular-margined, 3-lobed (?), aril firmly attached to the chalazal ¼ of the seed.

Sloanea lasiocoma Schum. is perhaps more closely related to *S. monosperma* than to *S. laurifolia* on the basis of the capsule, but the flowers show certain affinities with the latter species. It is distinguished from related species by the larger anthers often opening their entire length, by the 4-angled ovary, and by the longer spines on the subglobose capsule.

S. lasiocoma, like *S. monosperma*, is restricted in its distribution to the southeastern part of Brazil (see Map 5).

Brazil: Minas Geraes: Caldas near Pedra Branca, *C. A. Lindberg 491* Herb. Regnell III-1536 (Type-collection) (fr.) July 25, 1854 (NY, S). Paraná: Piraquara, Florestal, *G. Hatschbach 1025* (fl.) Oct. 10, 1948 (US). Santa Catherina: Brusque, *P. R. Rietz 3159* (fl.) Nov. 3, 1949 (US). Rio Grande do Sul: S. Francisco de Paula, Vila Oliva, *B. Rambo 31062* (fr.) Feb. 23, 1946 (S).

57. **Sloanea laurifolia** (Benth.) Bentham, Journ. Linn. Soc. Bot. **5:** suppl. 70. 1861.

Dasynema laurifolium Bentham in Hook, Journ. Bot. **4:** 132. 1842.
Sloanea oppositifolia Spruce ex Bentham, Journ. Linn. Soc. Bot. **5:** suppl. 70. 1861.
S. trinitensis Sandwith ex Williams and Cheesman, Fl. Trin. and Tob. **1:** 109. 1929.
S. excelsa Ducke, Archiv. Instit. Biol. Veg. Rio de Janeiro **2:** 161. 1935.
S. brachytepala Ducke, Trop. Woods **76:** 22. 1943.
S. venezuelana Steyerm., Fieldiana: Bot. **28:** 361. 1952.

Tree to 40 m. tall with radiating buttresses (*fide* Ducke). Twigs with striate, brown bark, new growth scarcely angled, often striate, glabrous to scattered-puberulent, lenticels often conspicuous, elongate, light in color. Leaves opposite to alternate; petioles 1.2–4 cm. long, striate, canaliculate above, more or less incrassate at both ends, glabrous to subpuberulent; blades 5.5–17.5 cm. long, 2.5–7.5 cm. wide, ovate to elliptical to obovate, coriaceous, often nitid above, midrib and secondary veins subimpressed, glabrous to puberulent above, midrib prominent, secondary veins distinct, glabrous to puberulent below, base subacute to obtuse to rounded, apex rounded to acuminate-obtuse, margin subentire to irregularly undulate. Inflorescences 2–6.5

cm. long, corymbo-racemose, several-flowered, peduncle 0.8–4 cm. long, often slender, at times somewhat laterally flattened, finely striate, glabrous to minutely puberulent, pedicels 0.5–2.3 cm. long, often slender, finely striate, glabrous to minutely puberulent, bracts 1–2 mm. long, lanceolate, minutely puberulent; flowers pale-cream (*fide* For. Dept. Brit. Guiana) or green (*fide* Ducke), 3–5 mm. long, 4–6 mm. in diameter, sepals 2–4 mm. long, 1.5–3 mm. wide, ovate, obtuse, often reflexed at anthesis, minutely puberulent without and within, more densely puberulent along the margins; stamens 2–3 mm. long, outer stamens often reflexed at anthesis, filaments 1–1.5 mm. long, puberulent or finely puberulent, anthers 0.25–1 mm. long, deltoid-lanceolate, glabrous to finely puberulent, opening by a lenticular pore or dehiscing most of their length, connective prolonged into a knob or a short, stout, glabrous to finely puberulent awn; pistil 1.5–4 mm. long, ovary about 1 mm. long, 0.75–1 mm. in diameter, subglobose, 4-loculed, puberulent, style 0.5–2 mm. long, often finely puberulent on the basal ½–⅔, apex 2–4-parted. Capsule green flushed pink (*fide* For. Dept. Brit. Guiana), 1.5–3.5 cm. long, subglobose, or ellipsoidal, 1-seeded, 4-valved; valves 1–5 mm. thick, finely puberulent, often granulose. Seed about 1 cm. long, enveloped in an apparently 3-lobed aril with irregular margin.

Sloanea laurifolia Benth. is a shrub or tree of the Amazon drainage and the Guianas with an extension into the island of Trinidad (see Map 5). The great variation within this species may be attributed to habitat-differences. The specimens which most closely approach the type-collection of the species are from areas of low land which may be periodically inundated, while collections more nearly like the type-collection of *S. brachytepala* are from higher, non-flooded habitats. With the number of collections now available, every intermediate form is represented. There is no doubt that the two extremes are conspecific. In describing *S. oppositifolia*, Bentham apparently did not realize the extent of variation in the species. *S. trinitensis* is not sufficiently distinct to warrant retaining it as a separate species; it fits into the pattern of variation seen in the collections from the continent. *S. excelsa* Ducke with very small leaves differs from the bulk of the collections only in size. Steyermark has compared *S. venezuelana* with *S. brachytepala* in respect to the length of pedicel and number of fruits. However, I do not feel that the differences are great enough to separate *S. venezuelana* adequately from *S. laurifolia*.

TRINIDAD: Cabasterre, Oroponche, *J. H. Hart 6737* (Type-collection, *S. trinitensis*) (fl. & fr.) July, 1899 (K). BRITISH GUIANA: Demerara River, *Jenman 6322* (fl.) Dec. 1891 (K, NY); Moraballi Creek, Essequibo River, Forest Dept. field F-463, record 3199 (fr.) Apr. 17, 1940 (K). VENEZUELA: BOLÍVAR: Río Guaña (Merevari) Guyana, *F. Cardona 1051* (fl.) Oct. 20, 1948 (VEN). AMAZONAS: Victorino, Río Guainía, *Llewelyn Williams 14814* (fr.) Mar. 21, 1942 (US); MONAGAS: Montaña de Aguacate, between Caripe and Caripito,

Steyermark 62216 (Type-collection, *S. venezuelana*) (fr.) Apr. 19, 1945 (F, S, VEN); ANZOÁTEQUE: Between Río León and "Carmelita" northeast of Bergantín, *Steyermark 61354* (fr.) Mar. 5, 1945 (A, F, NY, US, VEN). BRAZIL: AMAPÁ: Beira do Rio Oiapoque, rumando para Este, *Black 49-8410* (fl. past anthesis) Oct. 6, 1949 (BI); AMAZONAS: Rio Negro, *Rob. Schomburgk 936* (Type-collection, *Dasynema laurifolium*) (fl.) (F, GH, L); MANÁOS: Estrada do Aleixo, *Ducke* Herb. Jard. Bot. Rio de Janeiro 25120 (Type-collection, *S. excelsa*) (fl. & fr.) Dec. 10, 1932 (S, US); Colonium João Alfredo, *Ducke 862* (Type-collection, *S. brachytepala*) (fl. & fr.) Oct. 20, 1941 (BI, F, MO, US); Prope San Carlos ad Rio Negro, *Spruce 3689* (Type-collection, *S. oppositifolia*) (fl.) 1853–54 (F, GH, NY).

58. **Sloanea Berteriana** Choisy in DC., Prodr. 1: 516. 1824.

Tree to 25 m. tall (*fide* Beard). Twigs with brown, striate, often rough bark, new growth striate, scattered-puberulent. Leaves alternate; petioles 1–7 cm. long, striate, scarcely canaliculate above, incrassate at both ends, glabrate; blade 9–34.5 cm. long, 5–14 cm. wide, elliptical, chartaceous to coriaceous, midrib impressed, secondary veins subimpressed above, midrib and secondary veins prominent, glabrous beneath, base acute to obtuse, apex rounded to obtuse to acuminate-acute, margin irregularly undulate. Inflorescences to 3.5 cm. long, racemosely several-flowered, peduncles 1–2.5 cm. long, striate, glabrous to minutely scattered-puberulent, pedicels 8–12 mm. long, striate, minutely scattered-puberulent, bracts, if present, to 1 mm. long, deltoid, puberulent; flowers 5–8 mm. long, 7.5–10 mm. in diameter, at times reflexed, sepals reflexed at anthesis, 5–7 mm. long, 2–4 mm. wide, ovate to lanceolate-ovate, minutely scattered puberulent without, minutely puberulent within, margins more densely puberulent; stamens 3–6 mm. long, filaments 1.5–3 mm. long, finely puberulent to puberulent, tapering to the apex, anthers 1–2 mm. long, narrowly ellipsoidal, glabrous to finely puberulent, dehiscing most of their length, connective prolonged into a small puberulent knob; pistil 3–5 mm. long, ovary about 1 mm. long, 0.75–1 mm. in diameter, ovoid, 4-angled, 4-loculed, puberulent, style 2–3 mm. long, puberulent on the basal ¼ to ½, apex 4-parted. Capsule to 3.5 cm. long, ellipsoidal, usually 1-seeded, 4-valved; valves to 6 mm. thick, surface finely puberulent. Seed subglobose, almost entirely covered with an irregular-margined aril firmly attached to the chalazal ⅓ of the seed.

Sloanea Berteriana Choisy is a species of the West Indian islands from Hispaniola to Martinique (see Map 3). It is distinguished from other Antillean species of *Sloanea* by the large, ellipsoidal, unarmed capsules, and by the flowers with 4 sepals and stamens with relatively long filaments which taper from the base to the apex. It is very closely related to the following species, *S. Fendleriana*, but it may be distinguished by a larger fruit with thicker valves and subglobose seeds and by the generally larger size of the floral parts and inflorescence.

HISPANIOLA: DOMINICAN REPUBLIC: *Bertero s. n.* (Type-collection) (fl.) 1821 (F (photo)); LA VEGA: Cordillera Central, La Cumbre in forests toward Las Guananibas, *Ekman H-11465* Feb. 6, 1929 (S, US); SAMANÁ; Vicinity of Laguna, Pilón de Azucar, *W. L. Abbott 337* (fr. immature) Dec. 20, 1920 (US); DUARTE:

Cordillera Septentrional, S. Francisco de Macoris at Los Bracibos, *Ekman H-12301* (fl.) Apr. 26, 1929 (s, US). PUERTO RICO: Prope Adjuntas, Montis Ahorrado, *Sintenis 4619* (fl. past anthesis & fr.) June 20, 1886 (F, GH, L, MO, NY, US); Luquillo Mts., Catalina-Yunque trail, *Britton* and *Bruner 7675* (fr.) Feb. 23–26, 1923 (NY). ST. KITTS: Wingfield Mt., *Beard 300* (fl. & fr.) June 21, 1944 (A, MO). GUADELOUPE: Bains-Jaunes, *Duss 4011* (fl. & fr.) June 18, 1900 (F, MO, NY, US). MARTINIQUE: Entre la Camp Balata et le Camp Colson, *Duss 4445* (fl. & fr.) Aug., Sept., 1900 (F, GH, MO, NY, US).

59. **Sloanea Fendleriana** Bentham, Journ. Linn. Soc. **5:** suppl. 70. 1861.
S. Pittieriana Steyerm., Fieldiana: Bot. **28:** 359. 1952.

Tree to 30 m. tall (*fide* Steyermark). Twigs brown or gray-brown, striate, new growth scattered finely puberulent to puberulent. Leaves alternate; petioles 0.5–1 cm. long, striate, canaliculate, incrassate at both ends, glabrous to puberulent; blade 4–8 cm. long, 2.5–4.5 cm. wide, coriaceous, oval to elliptical to obovate, midrib and secondary veins impressed, glabrous to minutely scattered-puberulent above, prominent, glabrous to finely puberulent beneath, base acute to obtuse, apex emarginate to obtuse, margin entire to subundulate. Inflorescences 1–2.5 cm. long, 1–5-flowered, peduncle 8–18 mm. long, striate, finely puberulent, pedicels 4–7 mm. long, striate, finely puberulent; flowers green (*fide* Steyermark), reflexed, 4–5 mm. long, 7–8 mm. in diameter, sepals reflexed at anthesis, 3–4 mm. long, 1.5–4 mm. wide, ovate, minutely scattered-puberulent without, finely scattered-puberulent to puberulent within, margins densely finely puberulent; stamens 2–4 mm. long, filaments 1–2.5 mm. long, of equal diameter throughout their length, densely puberulent, anthers 0.5–1 mm. long, small ovoid, finely puberulent, dehiscing most of their length, connective prolonged into a small puberulent knob or short awn; pistil 3–5 mm. long, ovary 1–2 mm. long, 1–1.5 mm. in diameter, ovoid, 4-loculed, style 2–3 mm. long, glabrous to finely puberulent on the basal ⅔, apex usually 4-parted, often almost to the ovary. Capsule to 2.5 cm. long, about 1.5 cm. in diameter, ellipsoidal, 1-seeded, 4-valved; valves to 3 mm. thick, surface, densely minutely puberulent, granulose, at times with scattered, stout, conical prickles. Seed to 1.5 cm. long, ellipsoidal, almost entirely covered with an irregularly margined aril; fleshy, firmly attached to the chalazal ⅓ of the seed.

Sloanea Fendleriana Benth. is closely related to the preceding species. It is distinguished by the smaller inflorescences and flowers, and the smaller fruit which is granulose, and may be armed with stout prickles.

This species extends from the mountains of the Guyanas region of Venezuela to the higher non-flooded land of the Amazon basin (see Map 3).

The specimen from Bahia (*Bondar 2283a*) and that from Bolivia (*Buchtien 1689*) perhaps do not belong here as the valves of the capsule are thin and the outside of the capsules is smooth. In all other characters these specimens agree with *S. Fendleriana*.

VENEZUELA: Seaside of mountains between Macarai and Shoroni, *Fendler 2489* (Type-collection) (fl.) Oct. 26, Dec. 12, 1856 (GH). BOLÍVAR: Ptaritepui, *Steyermark 59984* (Type-collection, *S. Pittieriana*) (fl.) NOV. 10–11, 1944

(F, NY, VEN). BRAZIL: AMAZONAS: Humayata near Livramento on Rio Livramento, *Krukoff 6920* (fr.) Oct. 12–Nov. 6, 1934 (A, BI, F, K, MO, S, US); Manáos. Estrada do Aleixo, *Ducke 1913* (fr.) Feb. 15, 1946 (A, BI, F, NY). BAHÍA: *Bondar 2283a* (fr.) (F). BOLIVIA: Mapiri región, San Carlos, *Buchtien 1689* (fr.) Mar. 2, 1927 (US).

60. **Sloanea Dussii** Urban, Symb. Antil. **1**: 361. 1899.

Large tree (*fide* Duss). Twigs with reddish-brown, striate bark, new growth striate, pubescent. Leaves alternate; stipules to 1 cm. long, 1 mm. wide at the base, linear-lanceolate, pubescent, apex acute; petioles 1–1.5 cm. long, subterete, scattered-pubescent to pubescent; blades to 14.5 cm. long, 7.5 cm. wide, obovate, chartaceous, midrib and secondary veins impressed, pubescent above, prominent, glabrate below, base subacute, apex obtuse, margin subentire. Inflorescences unknown. Capsule on glabrous pedicel 1 cm. long; persistent sepals 1–1.5 mm. long, to 2 mm. wide at the base, puberulent without and within; capsule to 2.5 cm. long, ellipsoidal, 1 (?)-seeded, 4-valved; valves to 5 mm. thick, surface densely puberulent, covered with spines to 6 mm. long. Seed not seen.

Sloanea Dussii Urb. was described from poor material. As the species has not been recollected since Duss found it in Martinique, I have seen only the three specimens cited, none of which is complete. Although the subpersistent stipules are unusual for this group, the 4 sepals and characters of the capsule place this species in Section *Corymbo-racemi*.

S. Dussii is known only from Martinique (see Map 3).

MARTINIQUE: Fontaine Absalon, du Morne Vat, *Duss 1368, 4042* (Type-collection) (fr.) 1884, 1899 (NY, US).

61. **Sloanea echinocarpa** Uittien, Rec. Trav. Bot. Néerl. **22**: 354, fig. 8. 1925.

Tree. Twigs with brown, striate bark; new growth more or less angled, pubescent. Leaves alternate; stipules to 5 mm. long, 2 mm. wide, naviculate, ovate, midrib densely pubescent, margins thin, glabrous; petioles 9–12 mm. long, terete, densely pubescent, scarcely incrassate at both ends; blade 11–13.5 cm. long, 5–7 cm. wide, elliptical to obovate, chartaceous, midrib and secondary veins subimpressed, pubescent above, midrib undercut next to the blade so as to appear almost terete, secondary veins prominent, scattered-pubescent beneath, base subacute to acute, apex rounded to short-acuminate-obtuse, margin irregularly undulate. Inflorescences unknown. Persistent sepals at base of capsule 4, about 2 mm. long, 1.5 mm. wide, ovate, puberulent within; stamens (fragmentary, persistent at base of capsule) to 2 mm. long, filament 1.5 mm. long, pubescent, anther 0.5 mm. long, ovoid, puberulent, connective continued into a small knob. Capsule (immature) subglobose, 5-loculed, surface densely covered with stout, conical, minutely puberulent spines to 5 mm long.

Sloanea echinocarpa Uitt. in its foliage, pubescent young shoots, and 4 sepals and also in its persistent stipules is suggestive of *S. Dussii* Urb. In both of these species, collections are insufficient

to indicate their true relationships, but both seem to belong to this section.

I have seen only the type-specimen from Leiden which is sterile, an isotype from New York, and an additional specimen from Leiden with immature fruit. Beyond the flower-fragments which I have described, I find no flowering material. Uittien illustrated flowers (citing only these collections) and I must assume that these were reconstructions based upon the fragments which I have mentioned.

S. echinocarpa has been collected only in Dutch Guiana (see Map 3).

Dutch Guiana: Zandrij I, arbor 94, Herb. Acad. Rhenotraiect. 1307 (Type-collection) (st.) Oct., 1915 (L, NY); Herb. Acad. Rhenotraiect. 6053 (fr. immature) Jan. 26, 1923 (L).

62. **Sloanea grossa** C. E. Smith, spec. nov.

Arbor magna (*fide* Pittier). Cortex ramulorum fulvus, striatus, asper; surculi robusti, annulati, striati, dense tomentosi. Folia alternata; stipulae ignotae; petioli 9–12 cm. longi, striati, supra apice canaliculati, apice et basi incrassati, sparse tomentosi vel glabrati; lamina ad 31.5 cm. longa (apice ruptens in siccis) ad 18 cm. lata, ovata (?), crasse coriacea, nervus primarius et nervi secundarii supra tomentosi, subtus prominente striati tomentosi, basi rotundata, apice rotundata, inaequaliter undulata. Inflorescentia ignota. Capsula 4–5 cm. longa, subglobosa; valvae 4, ad 11 mm. crassae, lignosae, extus tenuiter granulosae. Semen 1, arillus ad marginem 5-lobatus, ad terminum chalazalem firme adhaerens.

Sloanea grossa is described on the basis of 2 Venezuelan collections which bear only fruit. The foliage of these specimens is poorly preserved, being badly broken or folded; thus it was impossible to obtain accurate measurements of the mature leaves. However, the distinctness of the material is apparent. The specific name refers to the large unarmed fruits which place this species in the present section. There are insufficient data present to make a more phylogenetic placement possible.

Although *S. grossa* has been found only in Venezuela, it is to be expected that there will be future collections from Colombia (see Map 3).

Venezuela: Aragua, Parque Nacional: Alturas de Guacamaya, *Pittier 15611* (fr.) Sept. 27, 1947 (US (Type), VEN); Fila de El Paraiso, al oeste de El Portochuelo de Rancho Grande, *Pittier* and *Navichenovich 15623* (fr.) Oct. 24, 1947 (US, VEN).

Species incertae sedis—**Sloanea Shankii** Standl. & L. Wms., Ceiba **3:** 213. 1953.

Tree to 8 meters, new branches thick, subterete, and, when dry, striate, glabrous, internodes short; leaves large, subcoriaceous, long-petiolate, petiole slender, 3.5–6 cm. long; blade broadly obovate to oval-obovate, at times widely elliptical, 14–19 cm. long, 8–12 cm. wide, apex broadly rounded, at times short, obtuse-apiculate, base sub-rounded to cuneate-obtuse, midrib and nerves dark, glabrous, not elevated above, midrib somewhat paler, glabrous when mature, thick, elevated beneath, lateral nerves about 10, elevated, soft, ascending at a wide angle, loosely anastomosing near the margin, veins loosely reticulate, venules minutely reticulate; fruit large, long (usually to 15 cm. long) pedunculate, globose, 5–7.5 cm. long and equally wide, densely covered with long, intertwined spines inserted on tubercles, valves woody, 2 cm. thick, glabrous within.

The description which is included here is the summary of the original description as the only specimen of this species available to me is sterile. I find no stipules persistent on the twig, but the stipular scars are large. This species probably belongs to subgenus *Quadrisepala*. It is readily set apart from other Central American species by the large capsule.

As yet *S. Shankii* has been found only in Honduras.

HONDURAS: COMAYAGUA: Río Tepemechín near Lago de Yojoa, *Shank 11684* (st.) Aug., 1947 (F).

REGIONAL KEYS TO SLOANEA

The following keys to species of *Sloanea* in Central America and the West Indies are provided for the convenience of workers in these special areas. The Central American key includes all species found from Mexico through Panama. The West Indian key includes species of the Greater and the Lesser Antilles and Trinidad. Where flowering material has been available, the main part of the keys has been based on floral characters. Characteristics of the fruit are given for all of the species for which the fruit is known. Although it is unlikely that additional species will be found in the West Indies, it is probably that additional new species and range-extensions of South American species will be discovered in Central America. These, of course, will not fit the present key for the area.

KEY TO THE CENTRAL AMERICAN SPECIES OF SLOANEA

A. Sepals 4–11, unequal in size and shape, not covering the essential organs in the bud.

B. Sepals never more than 5.

C. Flowers 3 mm. or less in diameter; connective continued only into a knob above the anther sacs.

D. Pistil 2–4 mm. long, ovary ovoid; capsule to 1.4 cm. long, ellipsoidal; spines to 4.5 mm. long, sparsely hirsute ..... 1. *S. meianthera.*

D. Pistil 5–7 mm. long, ovary obovoid; capsule to 2 cm. long, ovoid; spines to 1 cm. long, glabrous.....2. *S. Picapica.*
C. Flowers about 5 mm. in diameter; connective continued into a short awn; capsule (immature), subglobose; spines moderately hirsute.....3. *S. Brenesii.*
B. Sepals 5–11, free, or the calyx a 4–6-lobed plate.
E. Sepals free, 5–11.
F. Flowers generally less than 1 cm. in diam.
G. Flowers about 4 mm. in diameter; awn about ⅓ the length of the anther sacs; capsule to 2.5 cm. long; spines to 5 mm. long, rigid.....19. *S. faginea.*
G. Flowers 6–10 mm. in diameter, connective continued only into a knob or short stout awn.
H. Stipules 3–4 mm. long, linear-lanceolate; ovary smoothly globose; capsule (immature) to 1.5 cm. long; spines to 1.8 cm. long, puberulent...24. *S. guapilensis.*
H. Stipules 6–8 mm. long, lanceolate; ovary 4-angled, ovoid; capsule to 2.8 cm. long; spines to 1.8 cm. long, pubescent.....25. *S. Tuerckheimii.*
F. Flowers generally 1 cm. in diameter or more.
I. Bracts of the inflorescence 4–7 mm. long, ovate, serrate; ovary sub-globose, distinctly ridged; capsule unknown.....28. *S. mexicana.*
I. Bracts of the inflorescence 8–15 mm. long, lanceolate or obovate, undulate or sparsely dentate; ovary smooth or rounded-angled.
J. Stamens 10–11 mm. long, anthers ovoid, pubescent; "fruit sub-globose with dense aculeate rufous setae"—*fide* Pittier .....26. *S. megaphylla.*
J. Stamens 4–5 mm. long, anthers elliptical, short puberulent; capsule to 4.5 cm. long, sub-globose; spines to 3.5 cm. long, puberulent.....29. *S. medusula.*
E. Calyx a 4–6-lobed plate; stamens forming a compact ball; capsule to 2.5 cm. long, ellipsoidal; spines to 2.5 cm. long; minutely puberulent.....36. *S. zuliaensis.*
A. Sepals 4, equal in size and shape, covering the essential organs in the bud.
K. Capsule to 7.5 cm. long, globose; valves woody, to 2 cm. thick . . . Species incertae sedis.....*S. Shankii.*
K. Capsules at most 3 cm. long, ellipsoidal; valves not woody, to 3 mm. thick.
L. Capsule to 3 cm. long with spines tapered from the base, non-irritant, to 14 mm. long.....43. *S. petenensis.*
L. Capsule to 2.5 cm. long with clavate, irritant spines to 2 mm. long.....52. *S. terniflora.*

KEY TO THE WEST INDIAN SPECIES OF SLOANEA

A. Leaves spiny-margined.....15. *S. ilicifolia.*
A. Leaves entire, undulate, or dentate, but not spiny-margined.
B. Calyx of 4–9 sepals, unequal in size and shape, not covering the essential organs in the bud.
C. Stipules 10–20 mm. long, linear to lanceolate, more or less serrate-margined.....27. *S. dentata.*

C. Stipules 5 mm. long or less, margin entire.
D. Flowers 2–3 mm. in diameter; capsule to 7 mm. long, ellipsoidal; spines to 2 mm. long, hispidulous...4. *S. trichosticha.*
D. Flowers 6–9 mm. in diameter.
E. Stamens about equalling the sepals in length; connective prolonged into an awn ⅓ to ½ the length of the anther; capsule to 7 mm. long, ellipsoidal to sub-globose; spines 6–10 mm. long, pubescent. 23. *S. stipitata*
E. Stamens exserted from the calyx; connective continued only into a knob.
F. Sepals 3–3.5 mm. long, lanceolate, sparsely pubescent without, glabrous within; capsule to 3 cm. long, ellipsoidal; spines to 12 mm. long, scantily hispidulous.....13. *S. Massoni.*
F. Sepals 2–3 mm. long, deltoid to ovate, sparsely puberulent within and without; capsule to 2 cm. long, ellipsoidal; spines to 3 cm. long, densely pilose.....14. *S. curatellifolia.*
B. Calyx of 4 sepals, equal in size and shape or perianth of 2 whorls of 4 members each, covering the essential organs in the bud.
G. Inflorescences single-flowered.
H. Perianth in 2 whorls of 4 members each; capsules to 8 cm. long; spines to 5.5 mm. long.....46. *S. jamaicensis.*
H. Perianth of 4 sepals; capsules to 2.5 cm. long; spines to 1.5 mm. long, irritant.....53. *S. amygdalina.*
G. Inflorescences usually more than one-flowered.
I. Inflorescences cymose-paniculate; capsule to 2.2 cm. long, unarmed or with scattered stout prickles to 5 mm. long.....38. *S. caribaea.*
I. Inflorescences racemose, umbellate, or single-flowered, but not cymose-paniculate; capsule unarmed or armed with either irritant spines or flexible spines.
J. Capsules unarmed or with irritant spines; inflorescences racemose, umbellate, or single-flowered.
K. Inflorescences racemose; capsule to 3.5 cm. long, unarmed, finely puberulent...58. *S. Berteriana.*
K. Inflorescences umbellate, 1–3-flowered; capsule to 2.5 cm. long; spines to 1.5 mm. long, irritant.....53. *S. amygdalina.*
J. Spines of capsule flexible, to 6 mm. long; capsules to 2.5 cm. long; inflorescence unknown. 60. *S. Dussii.*

Species Unknown

Sloanea Regellii Schumann in Mart., Fl. Bras. 12 (3): 189. 1886.

The description which Schumann gives of this species does not include sufficient details to warrant its inclusion in any of the species known to me nor is it sufficiently clear to allow me to place

it with confidence in the proper section of the genus. However, the small caducous stipules and the floral characters indicate that it probably belongs to section *Brevispicae*. I have been unable to locate the type-collection (Engels, Nova Granada) or authentic material of this species. Probably the collector was Frans Engel who collected in Venezuela and Colombia in 1859-60. He was particularly interested in palms. His collection was advertised for sale in 1865, but I have been unable to find out to whom it may have been sold.

Species Excluded

Sloanea pentagona Donn. Sm., Bot. Gaz. **18:** 1. 1893.

This plant, obviously not a *Sloanea*, probably belongs in the family *Flacourtiaceae*.

Sloanea anisophylla Standl., Trop. Woods **16:** 14. 1928. Nomen nudum.

Mortoniodendron anisophyllum (Standl.) Standl. & Steyerm., Field. Mus. Pub. Bot. **17:** 411. 1938.

Orthandra anisophylla (Standl.) Burret, Notizbl. **15:** 13. 1940.

Sloanea anisophylla has been transferred to *Mortoniodendron* or *Orthandra* in the *Tiliaceae*.

Sloanea longicuspis Standl., Trop. Woods. **16:** 14. 1928.

Mayna longicuspis Standl., Trop. Woods. **52:** 27. 1937. Nomen nudum.

Sloanea longicuspis, described from a fruiting specimen, has been transferred to *Mayna* in the *Flacourtiaceae*.

In general aspect, the species of *Oncoba* and *Mayna* in the *Flacourtiaceae* closely resemble some of the species of *Sloanea*. They are readily differentiated by their petaliferous flowers with grouped stamens and usually many-seeded fruit which is moderately thin-walled.

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NO. CLXXVI

VASCULAR PLANTS OF THE HAMILTON RIVER AREA, LABRADOR

By
Ernst C. Abbe

STUDIES OF THE EUPHORBIACEAE, PHYLLANTHOIDEAE I. TAXONOMIC NOTES ON THE WEST INDIES SPECIES OF PHYLLANTHUS

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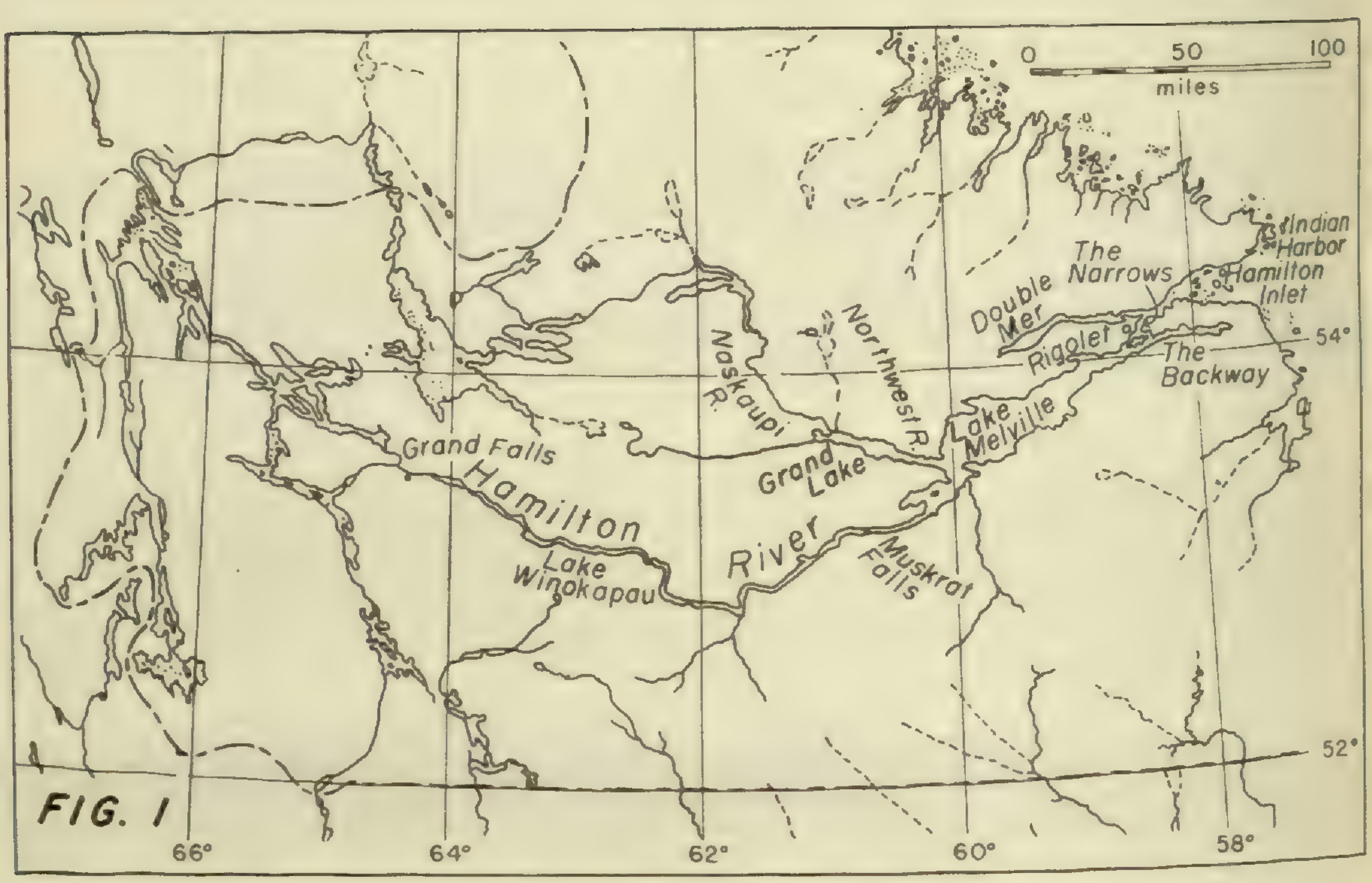

FIG. 1

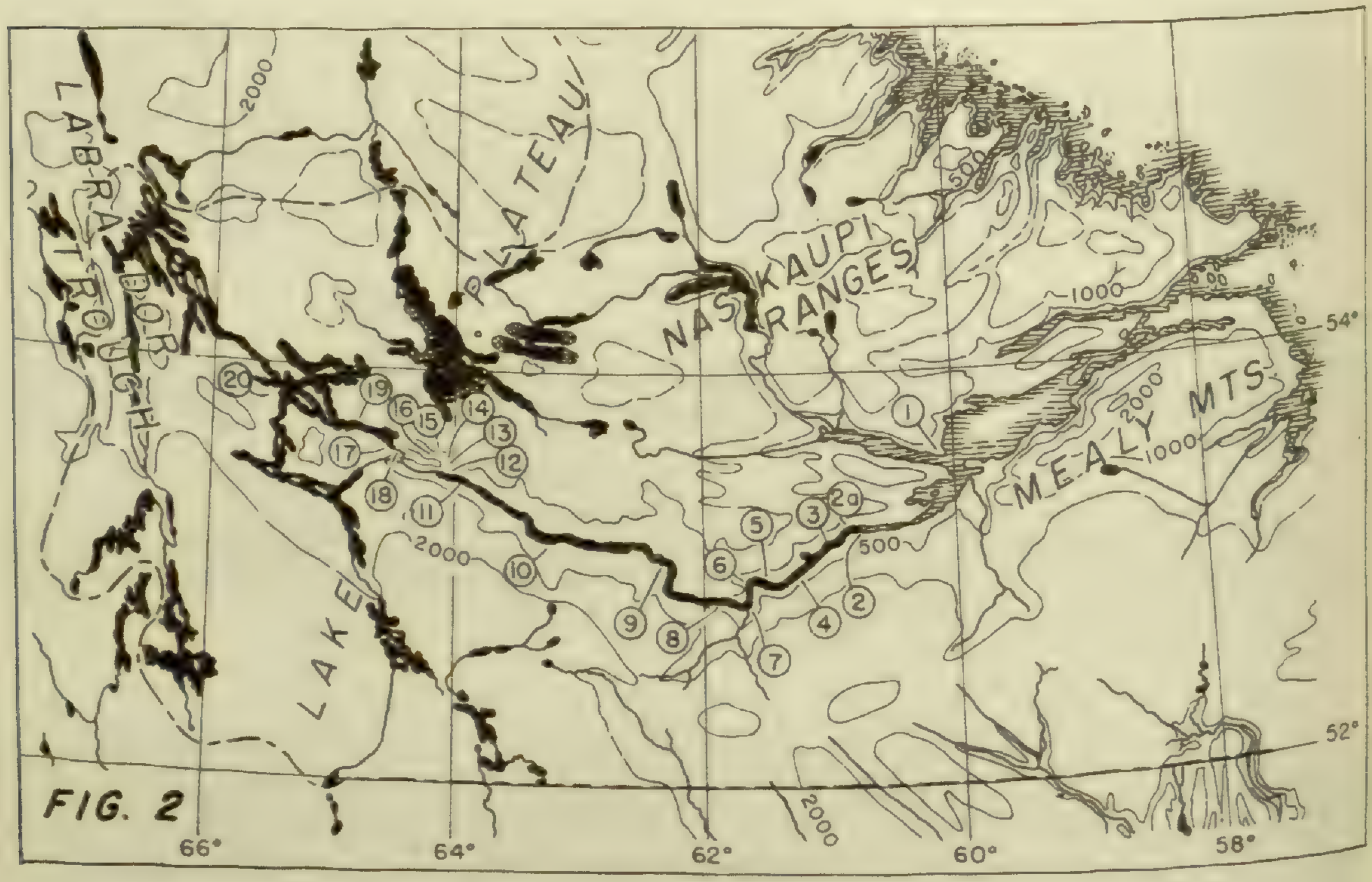

FIG. 2

FIG. 3

VASCULAR PLANTS OF THE HAMILTON RIVER AREA, LABRADOR [1]

By Ernst C. Abbe [2]

Part I. Introduction

The Carnegie Museum Expedition of 1939, under the leadership of W. E. Clyde Todd, had as its major objective the study of the transition from the "Arctic life zone" of the Atlantic coast to the "Hudsonian life zone" of the heart of the Labrador Peninsula. Todd (1939) states that "the chief scientific result of the expedition was the discovery that the valley of the Hamilton River, below the Grand Falls, belongs to the Canadian life zone".

The scientific personnel of the expedition comprised Dr. Todd, who was primarily concerned with ornithology, Dr. J. Kenneth Doutt, with mammalogy, and Dr. Margaret T. Doutt, with botany; they were accompanied by John and Leslie Michelin and Cecil Blake, all of Northwest River, as boatmen.

It is Mrs. Doutt's collection of vascular plants which forms the basis for the accompanying list. Her collection is of particular significance as the first relatively thorough one that follows this particular transect through to the central plateau of the Labrador Peninsula. The difficulties attendant upon arduous travel by canoe up this turbulent river were all that stood in the way of collecting a still more detailed suite of specimens.

Physiographically the Hamilton River-Lake Melville drainage system is one of great diversity (Fig. 2). The Hamilton River rises near the center of the Lake Plateau (Hare, 1952), a monotonously level peneplaned region. Tanner (1944), for instance, describes it from the air as "a great plain, strewn with a strange multitude of lakes and a veritable labyrinth of lakes and ponds, alternating with very extensive swamps and bogs". The elevation

1) A report on the vascular plants of the Carnegie Museum of Pittsburgh Expedition to the Grand Falls of the Hamilton River.

2) The work reported here was initiated while the writer was a Research Associate at the Gray Herbarium during the tenure of a John Simon Guggenheim Fellowship. Subsequent assistance has been provided by the Graduate School of the University of Minnesota and by the National Science Foundation (Grant NSF-G111).

Fig. 1. Major geographical localities in the Hamilton River area. Fig. 2. Major physiographic features, including contours (intervals of 500, 1000 and 2000 ft., following Flint et al. 1945), and the stations (nos. 1 - 20) at which collections were made by Dr. M. T. Doutt; for the names of the latter, see items numbered to correspond in Part II. Fig. 3. Section along the course of the Hamilton River; d. indicates delta (after Baulig, 1935).

of the plateau is about 1500 to 2000 ft. above sea-level. The Hamilton River is represented in this region primarily by a complex system of elongate lakes which lie more or less in the southern part of the Labrador Trough (Hare, 1952). At the Grand Falls the river plunges abruptly into its deeply entrenched valley. The geologist Low (1913), an eyewitness of the Grand Falls, says that just above the falls the river "dashes through a gorge about fifty yards wide with steep walls, one hundred and ten feet below its level at its upper end. In the last three hundred yards the grade is very steep, where the confined waters rush along in a swirling mass, thrown into enormous, long, surging waves, at least twenty feet high, the deafening noise of which completely drowns the heavy boom of the great falls immediately below. With a final great surge the pent-up water is shot down a steep incline for a hundred feet, where it breaks into a silvery mass and plunges into a circular basin two hundred feet below". The river continues down to Lake Melville in a narrow valley which is presumed to be pre-Pleistocene (Low, 1896; Tanner, 1944). It is deeply entrenched some 500 to 1000 feet in the Lake Plateau. Its course is frequently interrupted by rapids. Occasionally it is impounded to form long, narrow lakes, one of which, (Lake Winokapau), is over 400 feet deep. At sea level, the river enters brackish Lake Melville which is sometimes referred to as a fiord (Low, 1913), or again as a "ria" (Kindle, 1924). To the south of it lie the high and poorly known Mealy Mountains, mapped by Hare (1952) as uplifted plateau blocks (*cf.* Tanner, 1944); to the northwest lie the Naskaupi Ranges (Hare, 1952). Lake Melville is long and deep, shallowing at its eastern end to The Narrows which mark the transition to Hamilton Inlet, an extensive indentation in the Atlantic coastline of the Labrador Peninsula. The various features of the physiography of this drainage system have been discussed, among others, by Low (1896; 1913), Kindle (1925), Tanner (1944), and Hare (1952).

The bed-rock geology of the region has been described and discussed by Low (1896), Kindle (1924), and Tanner (1944). The upper Hamilton River lies in the eastern part of the Canadian Shield, a region of Archaean gneisses and granites intruded by volcanics and unconformably overlain here and there by Algonkian conglomerates, dolomites, etc. which again have been intruded by volcanics. The lower Hamilton River has cut deeply

into the basement formation which may in part be locally overlain by Keweenawan (?) sedimentaries similar to those occurring in abundance about Double Mer and Lake Melville. Extensive areas of eruptives of relatively recent date also occur. The homologies of the various formations are the subject of continuing discussion and investigation; it is to be hoped that ultimately there will be published the extensive geological research connected with the iron-ore developments of the interior. For a reconstruction of the orogeny of Labrador, see Tanner (1944). From the phytogeographical viewpoint, it is important that there are widely scattered areas of basic sedimentaries and basic volcanics in a region otherwise dominated by acid rocks.

The glacial geology of the region displays many of the familiar characteristics of late Wisconsin activity (Low, 1896; Kindle, 1924; Tanner, 1944). Along the upper reaches of the Hamilton River glacial striae and morainic material of various sorts roughly parallel the course of the river. Perched boulders are generally present above the level of the post-Pleistocene marine invasion and of bodies of water dammed by ice or morainic material. Great areas of terraces along the lower Hamilton and raised beaches about Lake Melville also provide evidence of impounded fresh water lakes and of isostatic changes which permitted rather recent marine invasion (Coleman, 1921; Kindle, 1924; Tanner, 1944; Wenner, 1947). It is Tanner's opinion that the ice lingered longer in the Lake Melville area than at higher elevations. As is the case with the bedrock geology, the glacial geology is badly in need of investigation. All that seems clear is that intensive glaciation has been carried on by an ice-sheet which completely covered the region and may have persisted for a time along the lower reaches of the Hamilton River and in Lake Melville. Extensive morainic deposits were left by the waning ice, often completely filling pre-glacial valleys. Insofar as the post-glacial drainage developed in pre-glacial valleys the morainic fill was largely excavated and transported downstream to form extensive deltas in Lake Winokapau and Lake Melville, or to contribute to beach and terrace formation in impounded and temporary lakes or inlets. These beaches are now above water level following the down-cutting of morainal dams or melting of ice-dams. In the region of marine submergence which extends from the coast well up the lower Hamilton River, there has been a post-glacial

elevation of some 300 feet, which is marked by raised marine beaches.

The contemporary climate in terms of temperature and precipitation is presented graphically (after Köppen and Geiger) in Abbe (1936). Mean monthly air temperature in May approximates 2° C., rises to 12° C. in July and drops to 8° C. in September; mean annual precipitation is about 750 mm., with about 75 mm. of this falling in July. Hare (1950) has re-emphasized the apparent major significance of July temperature in its relation to plant distribution, but he does not consider moisture to be limiting in this area. Perhaps more significant than such raw data are the precipitation-effectiveness and temperature-effectiveness indices given by Halliday (1937); these are brought up to date by Hare (1950) through the use of very recent climatological information in calculating moisture and thermal efficiency indices. Hamilton Inlet and the eastern part of Lake Melville are put by Hare in the cool microthermal, the western part of Lake Melville and the lower Hamilton Valley in the warm microthermal provinces. The moisture index ranges from a perhumid 120 in Hamilton Inlet to a minimum humid of 60 in western Lake Melville with a gradual increase in ascending the Hamilton Valley to 100 when the upland is reached. From the point of view of these two climatic indices the lower Hamilton Valley and western Lake Melville is an isolated climatic island with a combination of characteristics well north of their more general occurrence to the southwest. That other environmental factors such as soil type (and underlying rock type) and wind may become limiting must be borne in mind when attempts to explain distributional patterns are made through the use of these indices.

Wenner's (1947) study of pollen profiles in Newfoundland and Labrador provides the only available *direct* evidence for change in plant cover and therefore the only *indirect* evidence of climatic change. Wenner concludes (1947, pp. 122 and 132) that as the ice-sheet disappeared from southern Labrador there developed a tundra with woods of birch and alder "at any rate in certain places". This was followed by the invasion of the conifer forest, the presumed subarctic forest of birch and alder becoming restricted to its present position between the tundra and conifer forest. Extensive "paludification" has occurred since the conifer forest moved in. Non-differentiated pollen diagrams were obtained at

the Grand Falls of the Hamilton River, at Northwest River and at various stations in Hamilton Inlet; sites with "normal development" were found at the west end of the Lake Melville area and also on Hamilton Inlet; but sites with diagrams showing "revertence" to non-forest conditions were found only beyond present tree limit. "Normal development" after the disappearance of the ice is defined by Wenner (1947, p. 122) as generally being represented by a three-fold division of the pollen diagrams, namely, a lower zone of birch and alder, a middle zone indicating forest encroachment, and an upper zone of bog vegetation in forest surroundings; the latter is "paludification". "Revertence" in certain of the pollen profiles indicates a warm period which Wenner correlates with a time when sea-level shifted from about 20 meters to a few meters above present sea-level. Thus one may conclude from Wenner's observations that there was a cool periglacial climate when the ice was in its last retreat, a gradual warming to a thermal maximum in sub-recent time, followed (beyond present tree line) by slight climatic deterioration.

The general features of the contemporary vegetation of the Hamilton Inlet-Lake Melville-Hamilton River area have been well described by various travellers through the region. Wetmore (1923; *in* Kindle, 1924), Hustich and Pettersson (1945) and Wenner (1947) have given the most detailed descriptions of the Hamilton Inlet-Lake Melville portion; the observations of Wetmore and of Wenner also extend a short distance up the Hamilton River to Muskrat Falls. Of these only Wetmore (1923) and Hustich and Pettersson (1944) have presented an inventory of the vascular plants. It is their lists (plus a few records from Abbe, 1936) which are used as a base of reference for the Doutt collections cited in Part III of the present paper; a compilation of all these records is included in Part III.

The broad relationships of the woody flora of the Hamilton-Melville region with the rest of the Labrador peninsula have been skilfully described by Halliday (1937), Hustich (1949), and Hare (1950). Hare has modified the earlier work on forest geography and presents an up-to-date summary which is essentially ecological-geographical in its viewpoint. He considers that throughout the Labrador peninsula moisture is adequate to supply the needs of growth but that it may become limiting when present in excess as in muskeg. Thermal efficiency in terms of potential

evapotranspiration seems to be closely correlated with the distributional pattern of the forest regions as he maps these (Hare, 1950, Fig. 4). In spite of minor discrepancies he accepts thermal efficiency as the major factor which controls the contemporary limits of these forest regions. Hare characterizes the divisions of the boreal forest according to the relative development of the three dominant forest types which he has re-named: —

Close-forest type — "a continuous stand of closely spaced trees"; usually a thrifty black spruce-balsam fir association with a ground vegetation of mosses, *Cornus canadensis* and *Oxalis montana*; soil is water-retentive but well-drained.

Lichen-woodland type — "open stands of trees with a thick and beautiful floor of lichens"; spruces with the candelabrum habit are the most common tree species, and the lichens are various species of *Cladonia*; this type occurs on drier sites.

Muskeg type — slow-growing, slow reproducing gaunt black spruce, with ground cover of sphagnum, *Ledum groenlandicum* and *Chamaedaphne calyculata*; on badly drained ground.

South of the *tundra* there lie four zonal divisions of the *boreal forest*, which according to Hare, are characterized by their dominant forest types as follows: —

Forest-tundra ecotone — thin lichen-woodland in valleys; pure tundra on interfluves.
Open boreal woodland — lichen-woodland.
Main boreal forest — close-forest with spruce-fir associations.
Boreal-mixed forest ecotone — close-forest with white and red pine, yellow birch and "other non-boreal invaders".

Thus the zonal divisions are defined in terms of the relative frequency of the forest types.

Although the zonal divisions in the Labrador Peninsula as a whole tend to be latitudinal in sequence, their boundaries bend sharply southward along the Atlantic Coast. Consequently the east-west course of the Hamilton River-Lake Melville-Hamilton Inlet transect cuts across several of Hare's divisions of the boreal forest. The treeless eastern portion of Hamilton Inlet is in the fringe of tundra which extends along the Atlantic Coast. Hare (1950, p. 631) says that the presence of this tundra was "formerly thought to be the reflection of the chilling effect of the Labrador Current and its pack ice" but that "climatological

stations directly on this coastal tree-line .... show that the thermal efficiency is adequate to support lichen-woodland .... Evidently temperature alone is not responsible for the lack of trees". A rather limited forest-tundra ecotone is promptly followed by the open boreal woodland which extends from the western part of Hamilton Inlet to the eastern part of Lake Melville. The lichen-woodland (Hare, 1950, Fig. 4) then ascends to the plateau, surrounding an isolated "outlier of the main boreal forest" which occupies the valley of the lower Hamilton River and much of the area about Lake Melville. Hare's mapping of the forest types is in reasonably good accord with the accounts of travellers through the region.

The isolation of the outlier of the main boreal forest from its main body south of the Laurentide Scarp has been the subject of some speculation in the past. Hare (1950) maps it in essentially the same way as did Halliday (1937), but attributes its occurrence to a locally favorable combination of climatic factors expressed as thermal efficiency and moisture index; Halliday recognizes a probable correlation with climatic factors, but suggests that protection, heavier soil deposits and the nature of the underlying rock are major contributing factors as well.

Two obvious problems are thus clearly outlined in the distribution of forest regions in the Hamilton River-Lake Melville-Hamilton Inlet transect; one is the lack of correlation beween the Thornthwaite climatic indices and the location of the coastal tree line, the other is the presence in the lower Hamilton River valley of this massive northern representative of the close-forest of the southern watershed of the Labrador Peninsula. The Thornthwaite indices alone obviously cannot carry the full burden of explanation. It seems clear that further field work dealing with these problems should take into account factors other than gross climate as expressed by the Thornthwaite constants; among other factors which may contribute to these apparent anomalies are the role of strong coastal winds (including snow-blasting of buds), the relation of permafrost to root development and root competition, congeliturbation (*cf.* Raup, 1951), availability of nitrogenous compounds, some of the more subtle and essentially unexplored biochemical aspects of root competition, and the part played by the soil microfauna and microflora.

It is a temptation to suggest that the fine close-forest of the

lower Hamilton River valley is a post-glacial relic of a northerly extension of the main body of Hare's Main Boreal Forest during the thermal maximum. At first glance, it appears to be analogous to the relic stands of sugar maple on the North Shore of Lake Superior (Butters and Abbe, 1953). However, the facts at present available concerning the species composition of the lower Hamilton River forest hardly seem to support this proposition. Perhaps more intensive exploration will justify re-opening it.

The work of Halliday, Hustich, and Hare is pre-eminently concerned with the forest conditions in the region, and in a sense is ecological in its outlook. Only Delabarre (1913) has given a general floristic description. A more detailed floristic analysis may be attempted on the basis of the field work of Mrs. Doutt, R. H. Wetmore and E. M. Kindle, Hustich and the lesser collections of Todd and Abbe. In Part III the records of the Doutt collections are supplemented by the literature records of Wetmore, Hustich, and Abbe. Errors in identification and in synonymization undoubtedly are present in Part III, and in addition there are undoubtedly differences in intensity of collection in each of the four areas into which the region has been subdivided. Nevertheless the information available permits a preliminary attempt to determine the proportions of the arctic, boreal, and temperate contingents in the flora.

Each of the 340 native species (introduced species are excluded) in Part III has been classified in accordance with Scoggan's (1950) treatment of the species in the Gaspé flora. Most of the species in the region are also found in the Gaspé flora and, for these, Scoggan's geographical classification has been adopted without change. This has the advantage of permitting direct comparison of the region with his study of the Gaspé. The few dozen remaining species have been put into his categories as nearly as the distributional information permits. Scoggan's (1950, p. 30) latitudinal-longitudinal system is as follows: —

temperate circumpolar	temperate American	temperate eastern Amer.
boreal-temperate ,,	boreal-temperate ,,	boreal-temperate ,, ,,
boreal ,,	boreal ,,	boreal ,, ,,
arctic-boreal ,,	arctic-boreal ,,	arctic-boreal ,, ,,
arctic ,,	arctic ,,	arctic ,, ,,

In the Hamilton Inlet area there is a total of 193 species reported in Part III and summarized in Table 1. This is the

largest total for any of the four areas, partly due to the halophytic and arctic elements, and perhaps also due to more thorough collecting. By far the largest number of species (87) is in the arctic element which comprises 45% of the flora. The arctic-boreal group is 20% of the flora, with the boreal element somewhat larger (26%). The boreal-temperate, temperate and the disjunct American, and the amphi-Atlantic elements are all very small, varying from 1% to 3% of the flora. That the flora of this region is predominantly arctic is in keeping with the extensive development of the coastal tundra region, with a gradual transition to the rather sparse lichen-woodland toward The Narrows (*cf.* Fig. 4).

The Lake Melville area has 166 reported species (Table 1). It approaches the Hamilton Inlet area in total number of species, the halophytic element favored by its more or less brackish waters doubtless helping again to swell the total. However, unlike the Hamilton Inlet area, the largest single floristic element is the boreal one (51%), while the arctic element is only 22% of the flora. The arctic-boreal element is about the same proportion (20%) of the flora as in the Hamilton Inlet area, and the boreal-temperate, temperate and disjunct American are again but negligible constituents (1 to 4%). Thus there is a marked inversion in the proportions of arctic and boreal floristic elements in Lake Melville as contrasted with Hamilton Inlet. General observations of the vegetation support this statistical analysis, the lichen-woodland giving way to the thrifty close-forest toward the mouth of the Hamilton River. With the better development of the forest, there might well be expected an increase in the proportion of boreal species.

The lower Hamilton River area with its more limited variety of habitats has a smaller reported flora (100 species), due in part to the absence of the halophytes and in part to the limited botanical collecting in the area. It might also be expected that in this limited area, which is notable for its lush coniferous forest (close-forest), there would be a larger proportion of boreal elements than occurs in the Lake Melville area, but the difference is negligible (54% as compared with 51%). Interestingly enough the other elements of the flora also occur in essentially the same proportions as in the Lake Melville area, — arctic 20%, arctic-boreal 19%, boreal-temperate, temperate, and disjunct American

TABLE 1

Geographical distribution of species and varieties in the various areas compared with the Gaspé.

	Upper Hamilton R. (1)		Lower Hamilton R. (2)		Lake Melville (3)		Hamilton Inlet (4)		Gaspé (Scoggan, 1950)	
Arctic-										
-circumpolar	23		14		29		68		100	
-American	6		5		7		15		27	
-E. American	2		1		0		4		6	
Total	31		20		36		87		133	
Percent		28		20		22		45		13
Arctic-boreal-										
-circumpolar	10		12		18		24		37	
-American	9		5		14		12		25	
-E. American	2		2		2		3		8	
Total	21		19		34		39		70	
Percent		19		19		20		20		7
Boreal-										
-circumpolar	16		13		29		21		104	
-American	26		31		43		21		190	
-E. American	7		10		13		8		38	
Total	49		54		85		50		332	
Percent		44		54		51		26		33
Boreal-temperate-										
-circumpolar	1		0		2		3		26	
-American	3		2		0		1		81	
-E. American	1		1		1		2		82	
Total	5		3		3		6		189	
Percent		4		3		2		3		19
Temperate-										
-circumpolar	0		0		0		0		7	
-American	1		1		0		1		68	
-E. American	3		1		2		2		87	
Total	4		2		2		3		162	
Percent		4		2		1		2		16
Disjunct Amer.	1		2		6		5		62	
Percent		1		2		4		3		6
Amphi-Atlantic	0		0		0		3		9	
Percent		—		—		—		1		1
Endemics	0		0		0		0		43	
Percent		—		—		—		—		5
Totals	111		100		166		193		1000	

ranging from 2 to 3%. The strong similarity to the floristic proportions of the Lake Melville area is rather surprising.

The upper Hamilton River area, which lies on the upland, has 111 reported species. The proportion of arctic species (28%) is somewhat higher than in either the lower Hamilton River or Lake Melville areas, although it hardly approaches the 45% in the Hamilton Inlet area; in part, the arctic species of the treeless meadow on the south side of the Grand Falls expand the proportion of this element in the area. The arctic-boreal element is 19% of the flora of the upper Hamilton, very close to the proportion of this floristic component in each of the other three areas. The boreal element is somewhat smaller (44%) than in the lower Hamilton and Lake Melville areas, but appreciably greater than the 26% of the Hamilton Inlet flora. The boreal-temperate, temperate and disjunct American elements again are very small (1% to 4%). The proportions of the various constituents of the upper Hamilton flora are surprisingly similar to those of the lower Hamilton, even though the general aspect of the vegetation is known to be very different, — the forest is far less thrifty (lichen-woodland) where present and the great intervening areas given over to treeless tundra.

In the Gaspé peninsula, but a few degrees of latitude to the south, the flora is not only much larger (1000 species, according to Scoggan, 1950) than in the Hamilton-Melville region, but the relative proportions of its constituents are very different. The arctic element is but 13% of the total flora, whereas in the Hamilton-Melville region it ranges from 20 to 45%; the arctic-boreal element is only 7% in contrast to the 19 to 20% of the Hamilton-Melville region; the boreal element is intermediate between the 26% of Hamilton Inlet and the 44% to 54% of the rest of the Hamilton-Melville region. The boreal-temperate element is 19% of the Gaspé flora, significantly greater than the 2 to 4% of the Hamilton-Melville region. The temperate element is nearly as great (16%) and again significantly more than the 1 to 4% of the Hamilton-Melville region. The disjunct American element in the Gaspé is 6% of the flora, perhaps significantly more than the 1 to 4% in the Hamilton-Melville region. The amphi-Atlantic element is 1% of the Gaspé and 1% of the Hamilton Inlet but is absent in the rest of the Hamilton-Melville flora — hardly a noteworthy statistical difference. Of endemics

there have been none reported from the Hamilton-Melville region, but they constitute 5% (43 species) of the Gaspé flora — perhaps a tribute to the intensive taxonomic study which the Gaspé flora has experienced during the past half century. Certainly the general proportions of the Gaspé flora are notably more inclined to the temperate than is the case in any area in the Melville-Hamilton region.

The present statistical analysis suffers from a major shortcoming by the omission of classification by habitat types, but the general floristic picture is reasonably clear (Fig. 4). The floristic affinities of the Hamilton Inlet area are primarily with the treeless region to the north. The Lake Melville and upper Hamilton areas are very similar and establish between them a sort of norm for the floristic composition of the lichen-woodland interspersed with tundra components. But unlike as the close-forest of the lower Hamilton is in general aspect from the surrounding lichen-woodland and tundra, its floristic affinities are indistinguishable from it. The emphasis placed on this enclave of close-forest by the forest geographers continues to have a struc-

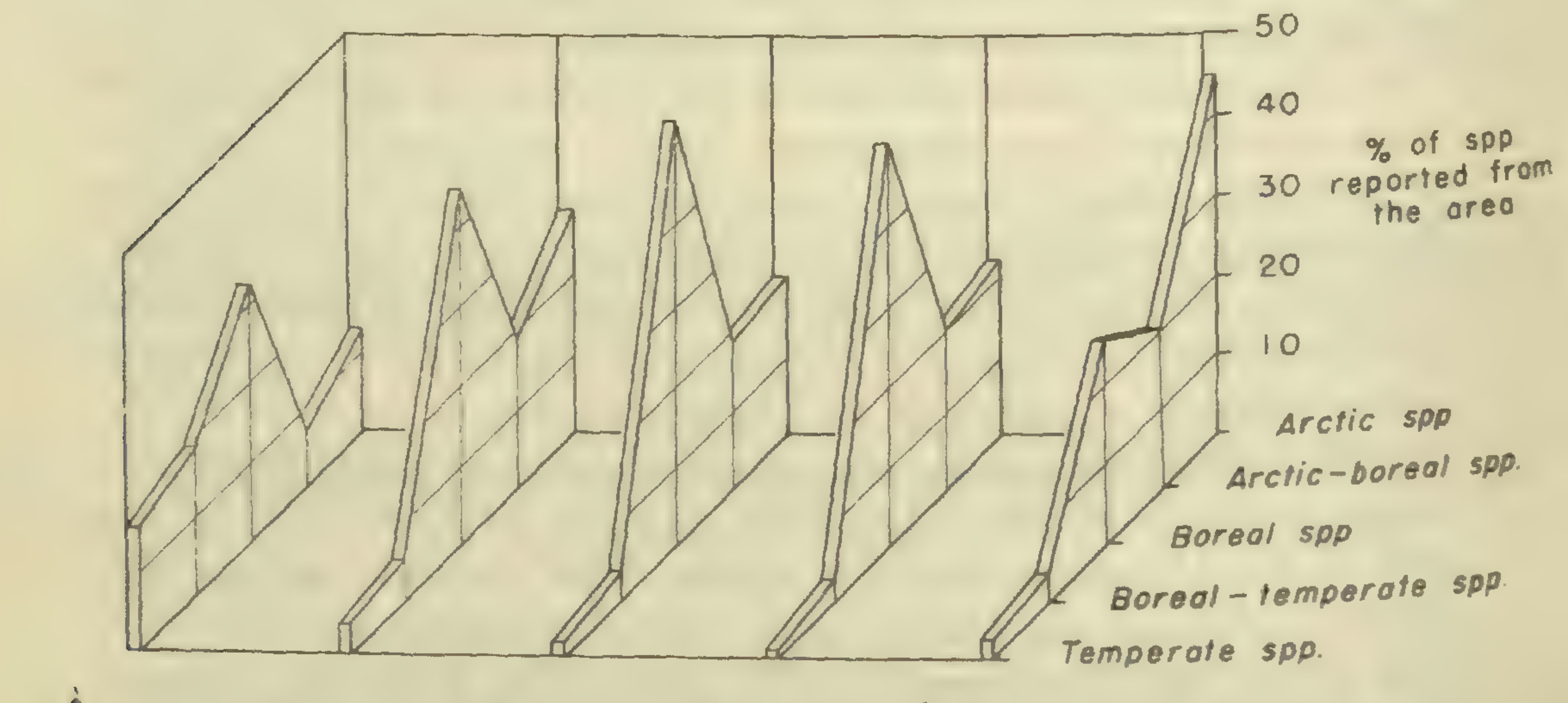

Fig. 4. The percentage of artic, artic-boreal, boreal, boreal-temperate and temperate species reported (*cf.* Part III) from each of the geographical sub-divisions of the Hamilton River-Lake Melville-Hamilton Inlet area, compared with the Gaspé flora as reported by Scoggan (1950). See Table 1.

tural justification only (*cf.* Hare, 1950, p. 618). It seems to be a simple response to more favorable edaphic and climatic conditions which have led to a different proportion of numbers of individuals. These individuals, however, belong to species whose geographic affinities are similar to those of the surrounding country. In fact it is much to be doubted that the Main Boreal Forest, if analyzed floristically, will prove to be particularly similar to the close-forest of the lower Hamilton, but instead will probably resemble more closely the Gaspé (Fig. 4). Certainly, for the time being, the close-forest of the lower Hamilton should not be characterized as an outlier of the Main Boreal Forest.

The tentative hypothesis that the close-forest of the lower Hamilton was formerly organically connected with the main body of the Main Boreal Forest, perhaps during the thermal maximum, finds no direct support in floristic grounds. Thus Wenner's (1947) failure to find palynological evidence for "revertence" in the wooded portion of the Melville-Hamilton transect is in no way at odds with the floristic evidence as interpreted above. There seems to be no evidence for a thermal maximum implicit in the contemporary plant cover. Interestingly enough, Raup's (1946) reconstruction of the forest history of the Athabaska-Great Slave Lake region is built on the assumption that there has been a gradual amelioration of climate in post-glacial time.

There is an interesting and apparently puzzling set of contrasts here. Beyond tree-line Wenner (1947) finds palynological evidence for revertence. At the southern limit of the coniferous forest Butters and Abbe (1953) offer evidence for a relatively recent hardwood invasion. At the northern and southern limits of the coniferous forest unlike biological evidence is offered for a common conclusion — namely a subrecent thermal maximum. But in the main body of the coniferous forest, including that of the west, such evidence is not forthcoming from the contemporary information. Either there was no thermal maximum, a conclusion which is at odds with the overwhelming mass of positive evidence in favor of its occurrence, or else the contemporary information is being interpreted inadequately. It seems probable to the writer that there is one major proposition which is significant — namely, that evidence for a thermal maximum can best be sought in the tension zone at the margins (southern, eastern, western, and northern) of the coniferous forest, where its components are

presumably approaching the limits of their ecological amplitude. It may logically be assumed that such climatic fluctuations in the area of the main body of the coniferous forest will leave little, if any, floristic evidence; the ecological amplitude of the species already there is probably more than sufficient to permit accommodation to the climatic changes associated with the recent thermal maximum. A minor proposition, which is applicable to great areas in the north, is that floristic evidence for climatic fluctuations must be sought only in the areas which have been free of ice, or free of water for a major portion of post-glacial time. The great areas covered until rather recently by lingering remnants of glacial ice or by impounded fresh water lakes or by marine "invasions" are hardly suitable as a source of primary floristic evidence. After all, they may have, and, in certain cases, surely have become available for occupation by land plants only since the thermal maximum.

ACKNOWLEDGEMENTS: Especial thanks are due the Director and staff of the Gray Herbarium for their friendly cooperation while the writer studied the collections there; the staff of the Herbarium of the Carnegie Museum, Pittsburgh has also been most helpful. Drs. J. K. and M. T. Doutt have most generously assisted in assembling the detailed data concerning habitats presented in Parts II & III. Mrs. Audrey Engels has rendered skilled clerical assistance. Finally, Dr. H. M. Raup, Director of the Harvard Forest, and Dr. Gerald Ownbey, Curator of the Herbarium of the University of Minnesota, have kindly read and commented upon Part I.

Part II. Stations at which botanical collections were made, Carnegie Museum Expedition, 1939.

Mrs. Doutt has made available the field notes which form the basis for the following account of the stations (see arabic numbers in circles, Fig. 2) at which her collections were made. Her notes are supplemented with identifications from Part III and some material from Low's (1896) account. Reference to the latter should be made for a detailed description of the region, including evidence of fires.

Station 1. Northwest River, Lake Melville; July 8, 1939. Field numbers 3038-3085. Back of the town of Northwest River the sandy beaches rise steeply toward the higher land to the north. On this dry, sandy terrain there is an open forest dominated by *Picea mariana; P. glauca* is rare. At the top of the slope about a mile from the town a few individuals of *Larix laricina* and of *Betula papyrifera* var. *cordifolia* are interspersed among the conifers, with *Salix humilis* var. *keweenawensis* a rather common associate. The well-drained, sandy soil is covered with a grey-white blanket of *Cladonia* and a large moss; numerous isolated individuals of *Vaccinium uliginosum* var. *alpinum, V. Vitis-Idaea* var. *minus* and *Empetrum nigrum* sprawl in this lichen mat. There was evidence of gathering of fire wood and other results of the nearness to the town.

In contrast to the dry slopes back of the town, there is a familiar group of halophytes and indifferent littoral plants along the sandy beach of Lake Melville. Above the high tide line *Lathyrus japonicus* and *Arenaria peploides* were accompanied by *Rumex Acetosella* and *Rorippa islandica* var. *Fernaldiana.* Back of this sandy beach is a dense shrubby zone in which *Alnus crispa* var. *mollis* and *Salix planifolia* up to 12 ft. high are dominant; fronting this alder zone is a fringe of *Myrica Gale.* At the upper edge of the beach *Elymus arenarius* var. *villosus, Arctophila fulva, Juncus filiformis, Poa pratensis* and *P. alpigena* form an extensive "grassy" zone, with *Carex canescens* in the moister areas.

Inland from the alder zone *Carex brunnescens* is frequent in swampy, peaty depressions.

Station 2. Muskrat Falls, Hamilton River; July 12, and 13, 1939. Field numbers 3086-3185. Along the river below Muskrat Falls the banks are covered with vegetation except where there have been erosion and slides in the sandy clay. *Alnus crispa* var. *mollis,* up to 12 ft. in height, dominates along the river bank with *Salix pyrifolia* a frequent associate; lower shrubs are *Rubus idaeus* var. *canadensis* and *R. glandulosus; Equisetum arvense* is common as ground cover. Pioneering on sandy, denuded spots were young seedling alders, *Achillea Millefolium,*

and on the moister slopes, *Agrostis alba. Heracleum maximum* is common in denuded areas on the sandy bank.

Two hundred feet higher, on top of this sand-clay terrace, there is a forest of *Abies balsamea* and *Picea mariana,* but paper birch is practically absent and *Pyrus decora* var. *groenlandica* is rare. In this forest there are bogs in which the sphagnum is over-run with *Gaultheria hispidula* and some *Vaccinium Oxycoccos* and *Rubus Chamaemorus.* In moist places in the conifer woods there is a scattered, woody undergrowth of *Ribes lacustre, Vaccinium myrtilloides, Viburnum edule* and *Cornus stolonifera.*

At the campsite near the upper end of the half-mile portage around Muskrat Falls, there was much evidence of former fires and clearing. White birch is locally abundant in the *Picea mariana-Abies balsamea* woods here. There are dense patches of dwarf birch, *Ledum groenlandicum, Chamaedaphne calyculata* and *Kalmia angustifolia.* Mosses and *Cladonia* cover the ground along with *Vaccinium Vitis-Idaea* and *V. uliginosum* var. *alpinum.*

Sandy terraces nearby are covered with *Cladonia* and an open *Picea mariana-Abies balsamea* woods with rare individuals of *Larix laricina;* these woods are very similar to those on the terraces back of Northwest River. The well-drained soil is doubtless responsible for the open character of these woods.

Muskrat Falls (only 20 feet high) is passed by means of a portage around the falls which is nearly a half mile long. It rises almost vertically at first through the sand of the much-eroded terrace, then follows a more gentle slope through spruce and fir woods, rises again nearly another hundred feet to the level top of the terrace, and finally drops down to the boulder-strewn river bank well up stream from the falls. A few feet back from the shore of the river there is a wide and dense shrubby zone composed of *Myrica Gale* nearest the river, and back of it *Salix pyrifolia, S. lucida, S. argyrocarpa, Alnus crispa* and *Cornus stolonifera.* In a moist, protected opening in the woods there are tall clumps of *Osmunda Claytoniana.* Between the edge of the river and the shrubby zone there is a narrow area on which there is a mixed growth of *Thalictrum polygamum, Dryopteris Phegopteris, Carex aquatilis, C. canescens, C. angustior, Scirpus rubrotinctus, Juncus brevicaudatus, J. filiformis, Trisetum spicatum* var. *molle* and *Calamagrostis canadensis.* Along the moist shore and in crevices among the boulders *Sanguisorba canadensis* is frequent.

Just to the north of the campsite there is a dune area which extends to the foot of the hills in the distance. In places where the dunes are stabilized, their rolling surfaces are covered with a carpet of lichens and of *Vaccinium Vitis-Idaea* var. *minus* with here and there a few

small individuals of *Populus balsamifera* and rarely a paper birch. Extensive thickets are formed by dwarfed *Betula glandulosa, Salix pellita* and *S. humilis* var. *keweenawensis.* Here and there occur individuals of *Prunus pensylvanica* and *Juniperus communis*; where there is reasonable cover there is an abundance of *Lycopodium complanatum* and of *L. clavatum.* Interestingly enough, *Picea glauca* occurs in this dune area, although it appears to be absent in the nearby river forest. There are extensive blowouts and moving dunes; a notable sand binder in this area is *Potentilla tridentata.*

John Michelin's philosophy concerning the origin of the dunes may be paraphrased, 'If a quick fire burns over the forest without destroying the top soil, you get white birch, if the fire burns slowly and several years in succession, you get *Populus tremuloides* and spruce; if it burns a long time and the top soil is completely destroyed, you get dunes: or - - perhaps the dunes were always that way!'

STATION 3. Sandy Banks (between Muskrat Falls and Porcupine Rapids), Hamilton River; July 16, 1939. Field numbers 3188-3198. Above Muskrat Falls the river flows through a wide valley. The banks are gray clay with a sand layer on the top. The distant hills rise some 800 feet above the wide valley floor; on the tops of the hills there are great stretches of light green due to *Populus tremuloides* which mingles with the dark green of the spruces and firs on the slopes.

The river banks have been much eroded by the river, which undercuts them so that great masses of trees and vegetation tumble and slide down into the river. In the faces of the exposed river banks the bank swallows have built nests extending inward 3 to 5 ft.; these they line with the black rhizomes of *Equisetum,* grass stalks and black duck feathers.

Collections were made on the south side of the river, where the sand banks rise 30 ft. above the water. In some places there is only a narrow crest at the summit with a drop-off into a depression away from the river. In this depression there is a pond being filled in on two sides by the encroaching sand. *Carex rostrata* borders the shallows of the pond, with *Sparganium* in the deeper parts. *Equisetum fluviatile* extends from the shallows up the wet sand of the bordering sand slope. Just beyond the *Carex* there is a zone of *Salix Bebbiana* and *Alnus.* The drifting sand in places has almost covered many individuals of *Populus balsamifera, Salix Bebbiana* and *Alnus crispa. Artemisia borealis,* with its long tap root, readily becomes established in the moving sand; it is accompanied by colonies of *Potentilla tridentata* and tufts of *Calamagrostis canadensis.* The dune is stabilized at its crest by *Juniperus communis,* spruces and firs; the ground under the latter has the familiar cover of *Pyrola virens, P. secunda, Vaccinium Vitis-Idaea* var. *minus* and miscellaneous mosses and lichens.

STATION 4. Porcupine Rapids, Hamilton River; July 17, 1939. Field numbers 3199-3203. Above Sandy Banks the river flows between about 14 miles of sandy terraces underlain by a characteristic blue clay. The high terraces are badly eroded and mats of vegetation slide down from the dense spruce and fir forest which covers the terrace. In the openings caused by fire in the coniferous woods, *Populus tremuloides* comes in, as well as *Amelanchier Bartramiana* which reaches a height of 5 ft. (the fruits of the latter were still green on this date; *Kalmia angustifolia* was just coming into flower). In moist places in the conifer woods there occur *Ranunculus lapponicus, Corallorhiza trifida, Carex brunnescens* and *Habenaria obtusata.*

STATION 5. Bull Island Rapids, Hamilton River; July 19, 1939. Field numbers 3204-3205. Above the Porcupine Rapids the river expands into Gull Island Lake, which is about six miles long by about a mile in width. Low says that the name "is a misnomer, as there is a very perceptible current throughout . . . ."

The rapids are two miles above Gull Lake and are surrounded by a luxuriant spruce-fir forest, with white birch, *Acer spicatum,* mountain ash. John Michelin says that the caribou eat the lichens which hang from the lower branches of the trees. The river bank is lined with boulders, some of which are huge, and with tangled, uprooted trees. The *Epilobium angustifolium* and *E. latifolium* along the shore were in full flower; there is the usual dense tangle of willows and alder between the shore and forest.

STATION 6. Horseshoe Rapids, Hamilton River; July 20, 1939. Field numbers 3206-3207. Collections were made around a small beaver pond in the spruce forest. At the edge of the pond there is *Chamaedaphne calyculata, Menyanthes trifoliata, Scheuchzeria palustris* var. *americana,* and sphagnum; in the deeper water *Nuphar variegatum* was in full flower.

STATION 7. Minipi River (mouth of), Hamilton River; July 22, 1939. Field numbers 3208-3210. The Minipi River enters south side of the Hamilton River just above Horseshoe Rapids. The immediate shores of the river are littered with large and small boulders. The shore is dominated by *Epilobium latifolium* and *Artemisia.* Where there is more soil on the landward edge of this zone, *Achillea* (interestingly enough called "Thousand Leaf" by the guides) and *Solidago multiradiata* occur. Progress along shore on foot is impeded by the tangled driftwood and by even greater tangles of trees and vegetation where slides have occurred in the gravel, sand or bouldery banks. On the slides grow *Anaphalis margaritacea, Epilobium glandulosum,* var. *adenocaulon,* and, very rarely, *Corydalis sempervirens.*

Above the shore there is an extensive conifer forest, lined on the river side by the usual *Alnus-Salix* zone. In the forest *Picea mariana* is very common, *Abies balsamea* frequent, but *Picea glauca* is rare. White birch is scattered through the forest and along rocky streams, and its light green was especially pronounced on the steep slopes across the river. In open clearings, *Kalmia angustifolia* was in full flower.

The hills rise steeply 500 or 600 feet above the river and their slopes are covered largely by white birch, *Populus tremuloides* and some spruce and fir.

STATION 8. Hamilton River, ten miles above the mouth of the Minipi River; July 24, 1939. Field numbers 3211-3219b. The character of the river valley above the Minipi Rapids changes; the river channel is narrow, bordered on both sides by 100 to 200 foot terraces of a fine silt which erodes like clay, and rising above these, high rocky cliffs or ridges about 800 feet above the river.

There is an extensive spruce forest in the valley, its dark blue-green broken here and there by the red-brown tops of individuals which have died because of girdling by porcupines during the winter. The local inhabitants use spruce to make beer; the branch tips are placed in boiling water, sugar and yeast are added — it is universally made and is used by young and old alike! In the forest openings around the tilts (trappers' cabins) and campsites the red raspberry and *Ribes glandulosum* are abundant; the latter, in spite of its "skunky" odor, is relished by the natives both as fresh fruit or for jelly.

On the sandy or bouldery shores of the river *Rubus pubescens,* with its long runners, is frequent; *Salix planifolia* gets to be 12 to 15 feet high with a tree-like growth habit. Under and near the edges of the willow copses *Carex Bigelowii* is common. Here and there on gravelly slopes with a southern exposure *Lychnis alpina* var. *americana* or *Prunus pensylvanica* occur.

STATION 9. Hamilton River, opposite the mouth of Cache River; July 25, 1939. Field numbers 3220-3224. Here a brief excursion into the spruce-fir forest turned up flowering material of *Listera auriculata, Pyrola asarifolia, P. minor* and *Moneses uniflora.*

STATION 10. Winokapau Lake (Long Point), Hamilton River; July 27, 1939. Field numbers 3225-3235. The east end of Winokapau Lake is eighteen miles above Cache River, the intervening portion of the river valley being narrow and crooked with steep, rocky walls, and few terraces. The downstream entrance of this long and narrow lake is marked by dramatically high cliffs which rise 1000 feet above the lake; on the steeply sloping talus below these cliffs there is a spruce-fir forest. So steep and rugged are the shores of the lake that no camp

site is available until sandy Long Point, thirty miles from the head end of the lake, is reached. Along the bouldery shore of the lake *Galium trifidum* and *Epilobium latifolium* are common. In the moister, rocky places bordering the river there is *Scutellaria epilobiifolia. Potentilla palustris* and *Iris versicolor* are abundant along the moist, swampy shores. Common species in the undergrowth of the moist spruce forest are *Mitella nuda, Carex brunnescens* and *Dryopteris Phegopteris.*

STATION 11. Hamilton River, 16 miles above the mouth of the Elizabeth River, and 7 miles downstream from Big Hill Portage; July 29, 1939. Field numbers 3236-3242. Here several beaver dams had formed small inlets among the willows; in the beaver ponds were *Utricularia vulgaris* and *Ranunculus trichophyllus* var. *eradicatus.* Along the muddy banks of the river were *Ranunculus reptans* and *Veronica scutellata.*

In general the vegetation is similar to that further downstream; there is a dense *Picea mariana* and *Abies balsamea* forest with a deep moss cover underfoot, and characteristic ground cover such as *Mitella nuda, Coptis groenlandica. Goodyera repens* var. *ophioides* and *Habenaria obtusata. Myrica Gale* is less abundant in the marginal zone than it was downstream.

STATION 12. Foot of Big Hill Portage, Hamilton River; Aug. 2, 1939. Field numbers 3243-3245. A tilt and a clearing lie at the foot of the portage, surrounded by red raspberries which are accompanied by *Circaea alpina* and *Aster puniceus*; along a brook in the near-by spruce woods were *Mentha arvensis* and *Actaea rubra.*

STATION 13. 2½ miles above the foot of Big Hill Portage; Aug. 4, 1939. Field numbers 3246-3256. The portage trail leads up from the river by a steep, almost vertical, route which, according to Low, ascends "700 feet in a quarter of a mile... It then passes over undulating wooded country, rising slowly for two miles to a small lake..." Although wooded in Low's time the whole surrounding country was severely burned in 1935; John Michelin said the fire occurred in early summer and attributed it to lightning. Everything was black from the fire and camp was pitched in the burned-over country. The whole area is most desolate, even the forest duff having been destroyed. Great quantities of *Epilobium angustifolium. Vaccinium angustifolium. Ledum groenlandicum* and *Chamaedaphne calyculata* have come in, as well as much *Betula glandulosa, Kalmia angustifolia, Carex brunnescens, C. paupercula, Deschampsia flexuosa* var. *montana,* and a few individuals of *Salix pellita.* Completely absent were spruces, fir, white birch and poplar.

STATION 14. Left-handed Lake, 5 miles above the foot of Big Hill Portage; Aug. 5, 1939. Field numbers 3257-3262. This plateau country

above the valley of the Hamilton River is very different in its general aspect from the lower reaches of the river. The trees are scattered in very open stands; *Cladonia* covers the ground in drier areas. Innumerable ponds, bogs and brooks mark the portage route. Around one of these small lakes there are sphagnum, *Chamaedaphne calyculata,* a little *Kalmia angustifolia, Solidago macrophylla* var. *thyrsoidea, Vaccinium uliginosum* var. *alpinum,* and an abundance of *Myrica Gale;* on drier ground nearby, there is *Vaccinium myrtilloides.*

STATION 15. Bog near Muskrat Lake; Aug. 6, 1939. Field numbers 3272-3291. This is still on the Big Hill Portage to the Grand Falls and had been burned over. *Picea mariana* and *Larix laricina* occur but are small. Shrubs present are *Myrica Gale, Andromeda glaucophylla* and *Betula Michauxii.* Herbaceous species here are *Sarracenia purpurea, Menyanthes trifoliata, Gentiana linearis. Solidago Purshii, Aster radula* var. *strictus, Drosera anglica, D. rotundifolia, Sparganium angustifolium, Juncus stygius* var. *americanus, J. brevicaudatus, Carex angustior, C. saxatilis* var. *miliaris, C. exilis, C. limosa, Eriophorum angustifolium, E. Chamissonis* and *Scheuchzeria palustris* var. *americana.*

STATION 16. Near Humbug Lake; Aug. 7, 1939. Field numbers 3292-3322. The route of the portage follows, in part, a brook which flows through a tamarack swamp into Humbug Lake. The brook is fringed by *Myrica Gale, Salix argyrocarpa, S. pyrifolia, S. pedicellaris* var. *hypoglauca. Calla palustris* is abundant. Submerged in the brook is *Potamogeton alpinus* var. *tenuiflorus.*

Around the muddy edges of a pond occur *Eleocharis acicularis* and *Juncus pelocarpus,* while at its swampy margin occur *Carex oligosperma, C. trisperma. C. rostrata, C. microglochin, Scirpus caespitosus* var. *callosus, Rubus Chamaemorus* and *Solidago Purshii.* Woody species surrounding the pond are *Salix discolor* (growing to a height of 6 ft.), *Betula borealis,* and *Alnus crispa* var. *mollis* (each up to 8 ft. high), *Kalmia angustifolia,* and *Empetrum nigrum;* in this woody thicket occur *Prunella vulgaris, Rorippa islandica* var. *Fernaldiana* and *Aster puniceus.* In the shallow water of the pond occur *Hippuris vulgaris. Utricularia vulgaris* and *Sparganium angustifolium.*

STATION 17. Upper end of Big Hill Portage (Hamilton River, 5 mi. above Grand Falls); Aug. 10, 1939. Field numbers 3323-3370. The region shares the characteristics of the rest of the plateau, being poorly drained with numerous bogs and morainic hills and ridges; rounded outcrops of granite are exposed here and there as little knobs. The woods are composed only of *Picea mariana* with an occasional white birch; the undergrowth consists of *Betula glandulosa. Ledum groenlandicum, Kalmia angustifolia, Cornus canadensis, Empetrum nigrum,*

Gaultheria hispidula, Vaccinium uliginosum var. *alpinum, Lycopodium annotinum* var. *pungens, Deschampsia flexuosa* var. *montana,* and *Equisetum sylvaticum.* On the moraines and sandy ridges there is a drier phase of the spruce woods, the trees being more scattered and the ground *Cladonia*-covered.

The bogs contain small individuals of *Larix laricina,* sedges and dwarf birch. A small *Eriophorum* bog had *Eriophorum Chamissonis* in the center, surrounded by a zone of *Carex disperma, C. pauciflora, C. paupercula,* and *Smilacina trifolia*; in turn this zone is surrounded by *Vaccinium Oxycoccos, Chamaedaphne calyculata* and sphagnum.

STATION 18. The Grand Falls, Hamilton River; Aug. 12, 1939. Field numbers 3371-3421. The tremendous plunge basin of the Hamilton River at the Grand Falls is surrounded by a spruce forest in which *Pyrus decora* var. *groenlandica, Streptopus amplexifolius, Listera cordata, Clintonia borealis, Galium triflorum* and *Dryopteris spinulosa* are present.

Notable on the south side of the Falls is a small meadow which is constantly blanketed by the mist which blows up from the plunge basin. The meadow has a northern exposure whose coolness is accentuated by the persistence of a snow bank along a small brook that runs through this anomalous patch of vegetation. At the edge of the meadow the *Picea mariana* becomes much dwarfed. On the banks of the brook grow *Viola adunca* var. *minor* and *Saxifraga aizoides;* and in a shallow pond, *Menyanthes trifoliata, Smilacina trifolia* and *Eriophorum angustifolium. Athyrium Filix-femina* grows around rocks in the meadow. The main sward of the meadow is composed of *Poa alpina, Carex stylosa* var. *nigritella, C. aquatilis, Scirpus caespitosus* var. *callosus, Rubus acaulis, Taraxacum lapponicum, Ranunculus abortivus* var. *acrolasius, Arabis alpina, Polygonum viviparum, Epilobium anagallidifolium, Coptis groenlandica, Parnassia parviflora* and *Equisetum sylvaticum.* There are occasional willows such as, *Salix arctophila* (prostrate), *S. cordifolia* var. *callicarpaea,* and *S. planifolia.* The famous calcicole *Salix vestita,* 1 to 2 ft. high, forms thickets on the glacial till which forms a steep slope next to the brink of the falls.

Along the rocky shore of the river just above the falls there were collected *Parnassia palustris* var. *neogaea, Sagina nodosa, Dryopteris disjuncta* and *Epilobium latifolium.* On the islands just above the falls large trees of *Picea glauca* occur. In general *P. glauca* seems to grow to larger size than does *P. mariana,* and grows on well-drained soil rather than in the swampy, wet types of habitat.

STATION 19. Flour Lake; August 15, 1939. Field numbers 3422-3426. "Above the Grand Falls", says Low, "the character of the river changes completely; it no longer flows in a distinct valley cut deep

into the surrounding country, but nearly on a level with the surface of the table-land, spreading out so as to fill the valleys between the long, low ridges of hills that are arranged in echelon all over the country. The river in passing around the ridges is often broken into several channels by large islands formed by separate ridges, and in other places, where there are wide valleys between the hills, it fills long, shallow lakes, with deep bays, and often studded with islands . . ." One of these lakes is Flour Lake. In mud among the rocks in shallow water of the lake *Isoetes muricata* and *Ranunculus trichophyllus* var. *eradicatus* occur. There is the usual willow-alder zone along the lake shore, in which were found *Polygonum viviparum, Viola adunca* var. *minor,* and *Habenaria dilatata.*

STATION 20. Sandgirt Lake; Aug. 16, 1939. Field numbers 3427-3432. According to Low "the south channel, leading out of Flour Lake is the ordinary canoe route. The distance by this channel between Flour and Sandgirt Lake is fifteen miles."

Collections were made at the lower end of Sandgirt Lake, at White Rapids. Along shore there occurred *Pinguicula vulgaris,* the first seen along the Hamilton River, *Petasites vitifolius* and *Alopecurus aequalis* var. *natans.*

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Part III. Vascular Plants Collected by Dr. M. T. Doutt in the Hamilton River Area (supplemented with certain relatively recent literature records).

In Part II is given the itinerary of the Carnegie Museum of Pittsburgh Expedition of 1939. The great mass of specimens was collected by Mrs. M. T. Doutt (MTD in the following list) and is on deposit at the Herbarium of the Carnegie Museum of Pittsburgh. A few duplicates are in the Herbarium of the University of Minnesota; these are designated by (M).

Because of the direct correlation between Mrs. Doutt's field numbers and the date of collection it is unnecessary to cite the latter in the list which follows.

Mrs. Doutt has very generously made her field notebooks available; from these have been gleaned the descriptive material (in parentheses) which follows the citation of each of her specimens. Furthermore her collection numbers have been carefully collated against her notebooks for precise geographic location; this is often given in rather general terms on her specimen labels. The order of citation of specimens is from east to west, following the course of the itinerary described in Part. II and shown in Fig. 2.

The order of arrangement of the species in the following list is that of Gray's Manual, ed. 8. Many of these records were made available to Prof. M. L. Fernald while he was at work on the last edition of Gray's Manual, and also to Dr. H. M. Raup when he was preparing the maps for The Botany of Southwestern Mackenzie, Sargentia No. VI. 1947.

Records from the literature are given immediately following the citation of Doutt collections, if any. The geographic sub-division is indicated by arabic numerals as follows:

1 — the upper Hamilton River, from the Big Hill Portage westward on the upland;

2 — the lower Hamilton River, from Muskrat Falls to the foot of the Big Hill Portage;

3 — Lake Melville, including The Backway, Grand Lake, Naskaupi River, and the islands and shores of Lake Melville proper (*cf.* Fig. 1);

4 — Hamilton Inlet, including The Narrows, Rigolet, Tikoraluk Head, Double Mer, and the islands of Hamilton Inlet proper (*cf.* Fig. 1).

The literature source is indicated by an initial which refers to the "Literature Cited" as follows: A — Abbe (1936); H — Hustich and Pettersson (1944); W — Wetmore (1923).

Presumed synonymy of literature records is given following the abbreviations for place and author. As nearly as possible the usage of Gray's Manual, ed. 8, is followed.

The Doutt collections and literature records constitute the basis for Table 1 and Fig. 4.

Equisetum arvense L. Hamilton River: Muskrat Falls (portage), MTD 3107 (steep sandy slope, pioneer on bare eroded sand). — 4H.

E. sylvaticum L. Hamilton River: Muskrat Falls (portage), MTD 3097 (in black spruce-Abies woods); 5 mi. above Grand Falls, MTD 3345 (open, black spruce woods); Grand Falls (south side), MTD 3378 (in meadow). — 3W, 4H; incl. var. *pauciramosum* Milde.

MTD 3345 may be referred to f. *multiramosum* Fern.; Mr. C. A. Weatherby pointed out to me that the "scabrosity on the angles of the branches is like the European" in MTD 3097.

E. palustre L. — 3W.

E. fluviatile L. Hamilton River: upstream from Muskrat Falls, MTD 3183 (around small lake, in water); Sandy Banks, MTD 3195 (margin of pond, in water and in wet sand of dune slope).

Lycopodium Selago L. — 4H.

L. annotinum var. **pungens** (LaPylaie) Desv. Hamilton River: upstream from Muskrat Falls, MTD 3130 (in forest near bog); 5 mi. upstream from Grand Falls, MTD 3343 (trailing in drier places in moss, open black spruce woods). — 2W, 3W, 4WH; incl. vars. *pungens* and *acrifolium* Fern.

L. clavatum L. var. **megastachyon** Fern. & Bissell. Hamilton River: upstream from Muskrat Falls, MTD 3167 (on sand dunes south of river).

L. obscurum L. — 3W.

L. sabinaefolium Willd. var. **sitchense** (Rupr.) Fern. Lake Melville: Northwest River MTD 3044a (on dry, sandy soil; associated with black spruce, *Salix* spp., *Vaccinium* spp. and *Empetrum* sp.; ground covered with lichens and a large moss).

L. alpinum L. — 3W.

L. complanatum L. Lake Melville: Northwest River, MTD 3044b (on dry, sandy soil; associated with black spruce, *Salix* spp., *Vaccinium* spp. and *Empetrum* sp.; ground covered with lichens and a large moss); Hamilton River; upstream from Muskrat Falls, MTD 3170 (on dunes). — 3W.

Selaginella Selaginoides (L.) Link. Hamilton River: Sandgirt Lake (White Rapids), MTD 3428 (among rocks in moist mud close to water). — 4A.

Isoëtes muricata Dur. Hamilton River: Flour Lake, MTD 3422 (in mud among rocks — shallow water).

Botrychium Lunaria (L.) Sw. — 3H.

Osmunda Claytoniana L. Hamilton River: upstream from Muskrat Falls, MTD 3126 (forming large clumps in protected spot among large rocks). — 3W.

Cystopteris fragilis (L.) Bernh. — 4H.

Onoclea sensibilis L. Hamilton River: Sandy Banks, MTD 3188 (along river).

Dryopteris disjuncta (Ledeb.) C. V. Mort. Hamilton River: Muskrat Falls (portage), MTD 3109; Grand Falls (south side), MTD 3411 (on rocks along river, in moist crannies). — 3W, 4WH; *D. Linnaeana* C. Chr., *Thelypteris Dryopteris* (L.) Slosson.

D. Phegopteris (L.) Christens. Hamilton River: upstream from Muskrat Falls, MTD 3132 (among rocks along shore); Winokapau Lake (Long Point),

MTD 3230 (spruce forest). — 2w, 3w, 4wh; *Thelypteris Phegopteris* (L.) Slosson.

D. spinulosa (O. F. Muell.) Watt. Hamilton River: Grand Falls (south side), MTD 3404 (spruce woods at edge of meadow). — 3w, 4w; *Thelypteris spinulosa* (O. F. Muell.) Nieuwl.

Athyrium Filix-femina (L.) Roth. Hamilton River: Grand Falls (south side), MTD 3396 (around rocks in meadow). — 3w; incl. var. *Michauxii; A. angustum* (Willd.) Presl.

Mr. C. A. Weatherby referred the above collection to f. *laurentianum* (Butters) Fern.

Abies balsamea (L.) Mill. Lake Melville: Northwest River, MTD 3046 (on dry, sandy soil covered with lichens and a large moss, dominantly black spruce with some birch and willow, shrubs *Vaccinium* spp. and *Empetrum);* also sight records on the lower and upper Hamilton River. — 3w, 4w.

Picea glauca (Moench) Voss. Sight records on the lower and upper Hamilton River by MTD.

P. mariana (Mill.) BSP. Lake Melville: Northwest River, MTD 3054b (on dry, sandy soil covered with lichens and a large moss, dominantly black spruce with some birch and willow, shrubs *Vaccinium* spp. and *Empetrum);* also sight records on the lower and upper Hamilton River.

Larix laricina (Du Roi) K. Koch. Sight records by MTD on the upper and lower Hamilton River, and in the Lake Melville area.

Juniperus communis L. Lake Melville: Northwest River, MTD 3053 (on dry, sandy soil covered with lichens and a large moss, dominantly black spruce with some birch and willow, shrubs *Vaccinium* spp. and *Empetrum);* Hamilton River, upstream from Muskrat Falls, MTD 3185 (sand dunes); Sandy Banks, MTD 3189 (in a sand blow along the shore). — 3w, 4h; incl. var. *montana* Ait.

MTD 3053 and 3189 are var. *saxatilis* Pallas; and MTD 3185 is var. *depressa* Pursh.

Sparganium angustifolium Michx. Hamilton River: Big Hill Portage (near Muskrat Lake), MTD 3291 (in small pond); Big Hill Portage (near Humbug Lake), MTD 3302 (in pond, tamarack swamp). — 3w.

S. hyperboreum Laestad. — 4a.

Zostera marina L. — 4h.

Potamogeton alpinus Balbis var. **tenuifolius** (Raf.) Ogden. Hamilton River: Big Hill Portage (near Humbug Lage), MTD 3296 (in brook through tamarack swamp). — *fide* E. C. Ogden.

P. gramineus L. — 3w; *P. heterophyllus* Schreb. var. *graminifolius* (Fries) Morong.

P. Richardsonii (Ar. Benn.) Rydb. Hamilton River: 5 mi. upstream from Grand Falls, MTD 3323 (in Hamilton River). — *fide* E. C. Ogden.

Ruppia maritima L. — 4h.

Triglochin maritima L. — 3w, 4h.

Scheuchzeria palustris L. var. **americana** Fern. Hamilton River: Horseshoe Rapids, MTD 3207 (small beaver pond surrounded by *Chamaedaphne*); Big Hill Portage (near Muskrat Lake) MTD 3274 (marsh around small pond near Muskrat Lake).

Festuca brachyphylla Schultes — 4h; ? *F. brachyphylla* Schult.

F. vivipara (L.) Sm. — 4h.

F. rubra L. — 3WH, 4WH.

Puccinellia phryganodes (Trin.) Scribn. & Merrill — 3H, 4H; incl. *Puccinellia* sp.

Glyceria borealis (Nash) Batchelder — 3W.

G. striata (Lam.) Hitchc. var. **stricta** (Scribn.) Fern. — 3W; *G. nervata* (Willd.) Trin. var. *stricta* Scribn.

Poa annua L. — 3H.

P. pratensis L. *sens. lat.*[3] Lake Melville: Northwest River, MTD 3082 (sandy beach). — 2W, 3W, 4W.

P. alpigena (Fries) Lindm.[3] Lake Melville: Northwest River, MTD 3083 (sandy peach). — 4H.

P. alpina L.[3] Hamilton River: Grand Falls (south side), MTD 3392 (meadow).

P. glauca Vahl — 3H, 4H.

P. eminens C. B. Presl. — 3WH, 4WH.

Arctophila fulva (Trin.) Anders. *Colpodium fulvum* (Trin.) Griseb. Lake Melville: Northwest River, MTD 3085b (sandy beach).

Agropyron repens (L.) Beauv. — 3H.

Hordeum jubatum L. — 3W.

Elymus arenarius L. var. **villosus** Mey. Lake Melville: Northwest River, MTD 3085c (sandy beach). — 3WH, 4WH.

Trisetum spicatum (L.) Richter var. **molle** (Michx.) Beal. Hamilton River: upstream from Muskrat Falls, MTD 3144 (among rocks along shore). — 3H, 4H; incl. var. *Maidenii* (Gandoger) Fern.

Deschampsia flexuosa (L.) Trin. var. **montana** (L.) Ledeb. Hamilton River: Big Hill Portage (foot), MTD 3246 (recently burned-over forest); 5 mi. upstream from Grand Falls, MTD 3344 (open black spruce woods). — 3W, 4WH; *sens. lat.* "D. caespitosa PB." — 3H.

D. atropurpurea (Wahlenb.) Scheele — 4H; *Vahlodea atropurpurea* Fr.

Calamagrostis canadensis (Michx.) Nutt. *sens. lat.* Hamilton River: upstream from Muskrat Falls, MTD 3146 (among rocks along shore); Sandy Banks, MTD 3198 (on newly blown sand). — 3W, 4W.

MTD 3146 is typical, while MTD 3198 is intermediate between typical and var. *robusta* Vasey.

C. neglecta (Ehrh.) Gaertn., Mey., & Scherb. — 3W, 4WH.

Agrostis alba L. Hamilton River: Muskrat Falls (portage), MTD 3105 (moist sand slopes along river).

This is placed in this species with some hesitation.

A. tenuis Sibth. — 3W; *A. alba* L. var. *vulgaris* (With.) Coss. & Dur.

A. geminata Trin. Hamilton River: Winokapau Lake (Long Point), MTD 3227 (clearing around tilt.) — ? 2W, ? 3W; ? *A. hyemalis* (Walt.) BSP.

A. borealis Hn. — 3H, 4H.

Cinna latifolia (Trev.) Griseb. — 2W, 3W.

Phleum pratense L. — 2W, 3WH.

P. alpinum L. — 3H, 4W.

Alopecurus aequalis Sobol. var. **natans** (Wahlenb.) Fern. Hamilton River: Sandgirt Lake (White Rapids), MTD 3429 (in mud — creeping).

3) F. K. Butters concurred in the determinations of the Doutt collections of Poa.

Hierochloë odorata (L.) Beauv. — 4AH.

H. alpina (Sw.) R. & S. — 4WH.

Eleocharis acicularis (L.) R. & S. Hamilton River: Big Hill Portage (near Humbug Lake), MTD 3297 (muddy edge of pond in tamarack swamp). — 3W.

E. palustris (L.) R. & S. — 3W.

Scirpus cespitosus L. var. **callosus** Bigel. Hamilton River: Big Hill Portage (near Humbug Lake), MTD 3310 (at margin of pond); Grand Falls (south side), MTD 3397 (wet meadow). — 4WH.

S. rubrotinctus Fern. Hamilton River: upstream from Muskrat Falls, MTD 3138 (among rocks along shore). — 3W.

S. atrocinctus Fern. f. **brachypodus** (Fern.) S. F. Blake — 3W. "S. uniglumis L." — 3H.

Eriophorum Scheuchzeri Hoppe — 4W.

E. Chamissonis C. A. Mey. Hamilton River: Big Hill Portage (near Muskrat Lake), MTD 3286 (marsh around small pond); 5 mi. upstream from Grand Falls, MTD 3351 (in center of *Eriophorum* bog). — 4WH.

E. spissum Fern. — 4WH; *E. callitrix* Cham.

E. gracile W. D. J. Koch — 3W.

E. angustifolium Honckeny. Hamilton River: Big Hill Portage (near Muskrat Lake), MTD 3282 (marsh around small pond); Grand Falls (south side), MTD 3390 (pond) and MTD 3394 (meadow). — 3W, 4W; *E. angustifolium* Roth.

Carex capitata L. — 4H; *C. arctogena* H. Smith.

C. gynocrates Wormsk. — 4H.

C. maritima Gunn. — 4H; *C. incurva* Lightf.

C. stipata Muhl. — 3W.

C. disperma Dew. Hamilton River: 5 mi. upstream from Grand Falls. MTD 3352a (*Eriophorum* bog in black spruce woods).

C. trisperma Dew. Hamilton River: Big Hill Portage (near Humbug Lake), MTD 3304 (margin of pond in tamarack swamp); 5 mi. upstream from Grand Falls, MTD 3352 (*Eriophorum* bog in black spruce woods). — 4H.

C. bipartita Bellardi *sens. lat.* — 3WH, 4WH; incl. *C. Lachenalii*, *C. glaucea* Wahlenb. and var. *amphigena* Fern., *C. marina* Dewey.

C. canescens L. Lake Melville: Northwest River, MTD 3064a (wet sand along beach); Hamilton River: upstream from Muskrat Falls, MTD 3136 and 3140 (among rocks along shore). — 3W.

C. brunnescens (Pers.) Poir. Lake Melville: Northwest River, MTD 3059 (swampy, peat); Hamilton River: Porcupine Rapids, MTD 3201 (in moist spruce and fir forest along river); Winokapau Lake (Long Point), MTD 3226 (in spruce forest); Big Hill Portage (2.5 mi. from foot), MTD 3253 (recently burned-over forest). — 2W, 3W, 4W.

C. exilis Dew. Hamilton River: Big Hill Portage (near Muskrat Lake), MTD 3281 (marsh around small pond).

C. echinata Murr. var. **angustata** (Carey) Bailey — 2W.

C. angustior Mackenz. Hamilton River: upstream from Muskrat Falls, MTD 3142 (among rocks along shore); Big Hill Portage (near Muskrat Lake), MTD 3289 (marsh around small pond).

C. projecta Mackenzie — 3W.

C. macloviana D'Urv. — 4WH.
C. aenea Fern. — 3H.
C. scirpoidea Michx. — 4AH.
C. deflexa Hornem. — 4H.
C. paleacea Wahlenb. — 3W, 4WH; *C. maritima* O. F. Mueller.
C. salina Wahlenb. var. **kattegatensis** (Fries) Almq. — 3W.
C. aquatilis Wahlenb. Hamilton River: upstream from Muskrat Falls, MTD 3135, 3137, 3143, 3145, and 3147 (among rocks along shore); Grand Falls (south side), MTD 3395 (in wet meadow).
C. Bigelowii Torr. Hamilton River: 10 mi. upstream from mouth of Minipi River, MTD 3216 & 3217 (along river bank under willows); 5 mi. upstream from Grand Falls, MTD 3370 (bog in spruce forest). — 3W, 4AH; *C. rigida* Good., *C. concolor* R. Br.
C. lenticularis Michx. — 3W.
C. stylosa C. A. Mey. var. **nigritella** (Drej.) Fern. Hamilton River: Grand Falls (south side), MTD 3393 (meadow), *teste* M. L. Fernald. — 4H; "C. stylosa (A. Meyer)".
C. rariflora (Wahlenb.) Sm. — 3W, 4WH.
C. limosa L. Hamilton River: Big Hill Portage (near Muskrat Lake), MTD 3277 (marsh around small pond).
C. paupercula Michx. *sens. lat.* Hamilton River: upstream from Muskrat Falls, MTD 3184 (in water of small lake); Big Hill Portage (2.5 mi. from foot), MTD 3254 (recently burned-over forest); 5 mi. above Grand Falls, MTD 3354 (bog, open black spruce woods).
MTD 3354 is typical (*teste* M. L. Fernald); MTD 3184 & 3254 are var. *irrigua* (Wahlenb.) Fern.
C. capillaris L. — 4H.
C. microglochin Wahlenb. Hamilton River: Big Hill Portage (near Humbug Lake), MTD 3309 (margin of pond in tamarack swamp).
C. pauciflora Lightf. Hamilton River: 5 mi. above Grand Falls, MTD 3353 (in *Eriophorum* bog, open black spruce woods). — 4H.
C. rostrata Stokes. Hamilton River: upstream from Muskrat Falls, MTD 3181 (around small lake); Sandy Banks, MTD 3194 (in small pond upon which a sand dune is encroaching); Big Hill Portage (near Humbug Lake), MTD 3308 (margin of pond in tamarack swamp). — 3W, 4H; ? "*C. rostrata* L. (v. *utriculata*)."
C. oligosperma Michx. Hamilton River: Big Hill Portage (near Humbug Lake), MTD 3307 (margin of pond in tamarack swamp).
C. vesicaria L. — 3W.
C. saxatilis L. var. **miliaris** (Michx.) Bailey. Hamilton River: Big Hill Portage (near Muskrat Lake), MTD 3285 (marsh around small pond). — 2W, 3W, 4H; *C. miliaris* Michx.; *C. saxatilis* L.
Calla palustris L. Hamilton River: Big Hill Portage (near Humbug Lake), MTD 3301 (along margin of brook in tamarack swamp).
Juncus trifidus L. — 4WH.
J. filiformis L. Lake Melville: Northwest River, MTD 3084 (beach); Hamilton River: upstream from Muskrat Falls, MTD 3141 (among rocks along shore). — 3W.

MTD 3141, *fide* S. C. Wadmond, who also suggests that MTD 3084 which is sterile belongs here.

J. balticus Willd. var. **littoralis** Engelm. Lake Melville: Northwest River, MTD 3085a (grass zone on sandy beach), *fide* S. C. Wadmond. — 2W, 3W, 4H; *J. balticus* Willd.

J. stygius L. var. **americanus** Buchenau. Hamilton River: Big Hill Portage (near Muskrat Lake), MTD 3272 & 3276 (marsh around small pond) — both *fide* S. C. Wadmond.

J. albescens Fern. — 4H.

J. brevicaudatus (Engelm.) Fern. Hamilton River: upstream from Muskrat Falls, MTD 3139 (among rocks along shore); Big Hill Portage (near Muskrat Lake), MTD 3288 (marsh around small pond) — both *fide* S. C. Wadmond.

J. alpinus Vill. var. **rariflorus** Hartm. — 3W; var. *insignis* Fries.

J. pelocarpus Mey. Hamilton River: Big Hill Portage (near Humbug Lake), MTD 3299 (muddy edge of pond in tamarack swamp) — *fide* S. C. Wadmond.

Luzula parviflora (Ehrh.) Desv. Hamilton River: upstream from Muskrat Falls, MTD 3179 (around small lake); Big Hill Portage (Left-handed Lake), MTD 3260 (edge of swamp); both *fide* S. C. Wadmond. — 4H.

L. spicata (L.) DC. — 4WH. "L. campestris (Lam.) DC." — 4H.

L. sudetica (Willd.) DC. var. **frigida** (Buchenau) Fern. — 4H; *L. frigida* (Buchenau) Sam.

Tofieldia pusilla (Michx.) Pers. — 4H; *T. borealis* Wg.

Clintonia borealis (Ait.) Raf. Lake Melville: Northwest River, MTD 3038 (dry, sandy soil covered with lichens and a large moss, dominantly black spruce with a few larches; birch and *Salix* rather common); Hamilton River: Muskrat Falls (portage), MTD 3088b (black spruce-*Abies* woods); Grand Falls (south side), MTD 3402 (spruce woods at edge of meadow). — 2W, 3W.

Smilacina trifolia (L.) Desf. Hamilton River: Muskrat Falls (portage), MTD 3089 (black spruce-*Abies* woods); 5 mi. upstream from Grand Falls, MTD 3350 (in *Eriophorum* bog, open black spruce woods), MTD 3389a (in shallow water of pond). — 3W, 4WH.

Maianthemum canadense Desf. Lake Melville: Northwest River, MTD 3049 (dry, sandy soil covered with lichens and a large moss; dominantly black spruce with a few *Larix* and scattered birch, *Salix* rather common). — 2W, 3WH.

Streptopus amplexifolius (L.) DC. var. **americanus** Schultes. Hamilton River: upstream from Muskrat Falls, MTD 3178 (around small lake); Grand Falls (south side), MTD 3387 (meadow), MTD 3400 (spruce woods on edge of meadow). — 3W; *S. amplexifolius*.

Sisyrinchium angustifolium Mill. — 3W.

Iris Hookeri Penny — 3WH, 4WH; *I. setosa* Pall. var. *canadensis* Foster.

I. versicolor L. Hamilton River: Winokapau Lake (Long Point), MTD 3235 (abundant along river wherever it is swampy) — *fide* R. C. Foster.

Habenaria hyperborea (L.) R. Br. — 3W.

H. dilatata (Pursh) Hook. Hamilton River: Flour Lake, MTD 3426 (along shore in willow-alder zone). — 4WH.

H. obtusata (Pursh) Richards. Lake Melville: Northwest River, MTD 3060 (swampy peat); Hamilton River: Porcupine Rapids, MTD 3203 (spruce forest);

7 mi. downstream from foot of Big Hill Portage, MTD 3241 (in spruce forest). — 4H. MTD 3060 & 3241 are typical, MTD 3203 is transitional to var. *collectanea* Fern.

Spiranthes Romanzoffiana Cham. — 3W.

Goodyera repens (L.) R. Br. var. **ophioides** Fern. Hamilton River: 7 mi. downstream from foot of Big Hill Portage, MTD 3240 (in spruce forest). — 3W.

Listera cordata (L.) R. Br. Hamilton River: Grand Falls (south side), MTD 3401 (spruce woods on edge of meadow). — 3W, 4H.

L. auriculata Wieg. Hamilton River: opp. mouth of Cache River, MTD 3222 (spruce-fir forest).

Corallorhiza trifida Chatelain. Hamilton River: Porcupine Rapids, MTD 3200 (spruce and fir forest along river). — 4A.

Salix [4] **lucida** Muhl. var. **angustifolia** Anderss. Hamilton River: upstream from Muskrat Falls, MTD 3159 (along river bank). — 3W; incl. var. *intonsa* Fern.

S. vestita Pursh var. **erecta** Anderss. Hamilton River: Grand Falls (south side), MTD 3374 (1 to 2 ft. high; on steep slope of glacial till).

S. herbacea L. — 4AH.

S. Uva-ursi Pursh — 4H.

S. arctophila Cockerell. Hamilton River, Grand Falls (south side). MTD 3372 & 3375 (prostrate in wet meadow). — 4AH. "S. glauca L." — 3H.

S. arctica Pallas — 4W; *S. anglorum* Cham.

S. cordifolia Pursh var. **callicarpaea** (Trautv.) Fern. Hamilton River: Grand Falls (south side), MTD 3377 (in wet meadow). — 4A; incl. vars. *intonsa* Fern. and *Macounii* (Rydb.) Schneid.

S. argyrocarpa Anderss. Hamilton River: upstream from Muskrat Falls. MTD 3160, 3162, & 3163 (along river); Big Hill Portage (near Humbug Lake). MTD 3292 & 3293 (small shrub, along brook in tamarack swamp); Grand Falls (south side), MTD 3376 (in meadow).

S. pyrifolia Anderss. Hamilton River: upstream from Muskrat Falls. MTD 3124 (6 ft. high, in dense thickets of *Salix* spp., alder, *Cornus stolonifera*); Big Hill Portage (near Humbug Lake), MTD 3294 (small shrub, along brook through tamarack swamp).

S. Bebbiana Sarg. Hamilton River: Sandy Banks, MTD 3190 (partly covered by sand in a sand blow).

S. pedicellaris Pursh var. **hypoglauca** Fern. Hamilton River: Big Hill Portage (near Humbug Lake), MTD 3295 (small shrub, along brook through tamarack swamp).

S. discolor Muhl. Hamilton River: Big Hill Portage (near Humbug Lake). MTD 3320 (6 ft. high; edge of pond). Raup considers the identity of this specimen to be questionable.

S. humilis Marsh. var. **keweenawensis** Farw. Lake Melville: Northwest River, MTD 3041 & 3051 (dry, sandy soil covered with lichens and a large moss; dominantly black spruce with some white spruce, a few *Larix*, scattered birch and *Salix* rather common); Hamilton River: upstream from Muskrat Falls, MTD 3173 (in dunes along river bank).

S. planifolia Pursh. Lake Melville: Northwest River, MTD 3062 (shrubs

4) All cited specimens of *Salix* were examined and determined by H. M. Raup. See his "The willows of the Hudson Bay region and the Labrador peninsula". Sargentia IV: 81-127. 1943.

12 ft. high; among alders, along river); Hamilton River: 10 mi. upstream from mouth of Minipi River, MTD 3214 & 3215 (12 to 15 ft. high with tree-like habit, very gray bark and shining glands on under side of leaves; along river bank); Grand Falls (south side), MTD 3376a (meadow). — 3W.

S. pellita Anderss. Hamilton River: upstream from Muskrat Falls, MTD 3172 (in dunes along river bank); Big Hill Portage (2.5 mi. from foot), MTD 3252 (recently burned-over forest).

Populus tremuloides Michx. — 3W.

P. balsamifera L. Hamilton River: Sandy Banks, MTD 3192 (being covered by sand in a sand blow along shore).

Myrica Gale L. Lake Melville: Northwest River, MTD 3064b (in wet sand of beach); Hamilton River: Big Hill Portage (near Muskrat Lake), MTD 3278 (marsh around small pond). — 3W, 4H.

Betula papyrifera Marsh. var. **cordifolia** (Regel) Fern. Lake Melville: Northwest River, MTD 3042 & 3045 (dry sandy soil covered with lichens and a large moss; dominantly black spruce with some white, a few *Larix,* scattered birch and *Salix* rather common); Hamilton River: 10 mi. upstream from mouth of Minipi River, MTD 3219a (small leaves from shoot growing from cut stump of old one; very different from big leaves of older tree).

B. borealis Spach. Hamilton River: 10 mi. upstream from mouth of Minipi River, MTD 3219aa; Big Hill Portage (near Humbug Lake), MTD 3321 (8 ft. high; tamarack swamp).

B. glandulosa Michx. Lake Melville: Northwest River, MTD 3039 (dry sandy soil covered with lichens and a large moss; dominantly black spruce with some white, a few *Larix* and scattered birch with *Salix* rather common); Hamilton River: upstream from Muskrat Falls, MTD 3171 (on dunes); Big Hill Portage (2.5 mi. from foot), MTD 3249 (recently burned-over forest); 5 mi. upstream from Grand Falls, MTD 3337 (shrub 4 ft. high, open, black spruce woods) — 3W, 4WA.

B. Michauxii Spach. Hamilton River: Big Hill Portage (near Muskrat Lake), MTD 3284 (1 ft. high; in swamp around small pond).

? **B. microphylla** Bunge — 3W.

Alnus crispa (Ait.) Pursh var. **mollis** Fern. Lake Melville: Northwest River, MTD 3052 (dry, sandy soil covered with lichens and a large moss; dominantly black spruce with some white and a few *Larix* and scattered birch, *Salix* rather common), MTD 3065 (dominating the shrubby zone behind sandy beach along river); Hamilton River: Muskrat Falls (portage), MTD 3103 (12 ft. high; steep, sandy bank and also along edge of river. The young plants pioneer on eroded sand slopes); Big Hill Portage (near Humbug Lake), MTD 3322 (8 ft. high; along brook through tamarack swamp). — 3W.

Geocaulon lividum (Richards.) Fern. Lake Melville: Northwest River, MTD 3050 (dry, sandy soil covered with lichens and a large moss; dominantly black spruce with some white and a few *Larix,* scattered birch with *Salix* rather common). — 3W, 4WH; *Comandra livida* Richards.

Rumex mexicanus Meissn. — 4H; *R. salicifolius* Wein.

R. fenestratus Greene — 3WH, 4H; *R. occidentalis* Wats.

R. Acetosella L. Lake Melville: Northwest River, MTD 3081 (sandy beach above high tide). — 3WH.

R. Acetosa L. "coll. v." — 3H.

Polygonum aviculare L. — 3WH, 4H.

P. viviparum L. Hamilton River: Grand Falls (south side), MTD 3391 (meadow); Flour Lake, MTD 3424 (along shore in willow-alder zone). — 3W, 4WH.

Chenopodium album L. — 3WH.

Montia lamprosperma Cham. — 4H; *M. fontana* L.

Sagina procumbens L. — 4H.

S. nodosa (L.) Fenzl (typical). Hamilton River: Grand Falls (south side), MTD 3410 (in moist crannies of rocks along river).

Arenaria lateriflora L. — 3WH; *Moehringia lateriflora* (L.) Fenzl.

A. peploides L. *sens. lat.* Lake Melville: Northwest River, MTD 3068 (forming colonies in lowermost zone on sandy beach). — 3W, 4WH; *Ammodenia peploides* (L.) Ehrh.

A. groenlandica (Retz.) Spreng. — 3W, 4H..

A. rubella (Wahlenb.) Sm. — 4A; *A. verna* L. var. *pubescens* (Cham. & Schl.) Fern.

Stellaria media (L.) Cyrillo — 3WH.

S. longipes Goldie, var. **laeta** (Richards.) Wats. — 3W, 4WH; "*Alsine longipes* (Goldie) Coville".

S. humifusa Rottb. — 3WH, 4H; *Alsine humifusa* (Rottb.) Britt.

S. crassifolia Ehrh. — 3W.

S. calycantha (Ledeb.) Bong. — 3W, 4H; *S. borealis* Bigel., *Alsine borealis* (Bigel.) Britt.

Cerastium alpinum L. — 3H, 4WAH; incl. var. *lanatum* (Lam.) Hegetschw.

C. arvense L. — 4W.

Lychnis alpina L. var. **americana** Fern. Hamilton River: 10 mi. upstream from mouth of Minipi River, MTD 3211 (rose colored flowers; gravelly slopes with southern exposure).

Silene acaulis L. var. **exscapa** (All.) DC. Hamilton Inlet: Indian Harbor, Todd (s.n.) July 20, 1920. — 3WH.

Nuphar variegatum Engelm. Hamilton River: Horseshoe Rapids, MTD 3206 (small beaver pond). Apparently this is the first record of this species for the Atlantic watershed of the Labrador Peninsula.

Ranunculus trichophyllus Chaix var. **eradicatus** (Laestad.) W. B. Drew. Hamilton River: upstream from Muskrat Falls, MTD 3180 (in water of small lake); 7 mi. downstream from foot of Big Hill Portage, MTD 3238 (in beaver pond); Flour Lake, MTD 3423 (in mud among rocks in shallow water). — ? 4H; ? "*Batrachium heterophyllum* (Chaix) F. Schulz".

R. Cymbalaria Pursh — 3H, 4H.

R. hyperboreus Rottb. — 4W.

R. lapponicus L. Hamilton River: Porcupine Rapids, MTD 3199 (moist spruce and fir forest along river). — 3W, 4WH.

R. reptans L. Hamilton River: 7 mi. downstream from foot of Big Hill Portage, MTD 3236 (wet mud along river banks and ponds). — 3W, 4H.

R. abortivus L. var. **acrolasius** Fern. Hamilton River: Grand Falls (south side), MTD 3386 (meadow).

R. pensylvanicus L. f. — 3W.

R. acris L. — 3WH.

Thalictrum polygamum Muhl. Hamilton River: upstream from Muskrat Falls, MTD 3134 (among rocks along shore). — 3W.

Coptis groenlandica (Oeder) Fern. Hamilton River: Muskrat Falls (portage), MTD 3087 (black spruce-*Abies* woods); Grand Falls (south side), MTD 3385 (meadow). — 3H; *C. trifolia* (L.) Salisb.

Actaea rubra (Ait.) Willd. Hamilton River: Big Hill Portage (foot), MTD 3245 (spruce woods along brook). — 3W.

Corydalis sempervirens (L.) Pers. Hamilton River: Minipi River (mouth), MTD 3208 (pink and yellow flowers; steep gravel, sand, and boulder slide; only two plants seen).

Judging by Ownbey's monograph of *Corydalis* (Ann. Mo. Bot. Gard. 34:212. 1947), this is a notable northward range extension and the first record for the Labrador Peninsula.

Draba nivalis Lilj. — 4A.

D. incana L. — 3WH, 4WH; incl. var. *confusa* (Ehrh.) Lilj.

Thlaspi arvense L. — 3WH.

Subularia aquatica L. — 4H.

Capsella Bursa-pastoris (L.) Medic. — 3WH, 4W.

Cochlearia groenlandica L. — 4H.

C. arctica Fr. — 4H. **C. sp.** — 4W.

Descurainia Richardsonii (Sweet) O. E. Schulz — 3H; ? *Sisymbrium Hartwegianum* Fourn.

Rorippa islandica (Oeder) Borbás var. **Fernaldiana** Butters & Abbe Lake Melville: Northwest River, MTD 3067 (among grasses near shore); Hamilton River: Big Hill Portage (near Humbug Lake), MTD 3315 (on clay and stones, among willows at edge of pond).

MTD 3067 is assigned to this var. with doubt because of its youth and generally depauperate condition.

Cardamine pratensis L. — 4H.

Arabis alpina L. Hamilton River: Grand Falls (south side), MTD 3382 (meadow).

A. Drummondii Gray — 4H.

Sarracenia purpurea L. Hamilton River: Big Hill Portage (near Muskrat Lake), MTD 3273 (marsh around small pond). — 3W.

Drosera anglica Huds. Hamilton River: Big Hill Portage (near Muskrat Falls), MTD 3275 (marsh around small pond).

D. rotundifolia L. Hamilton River: Big Hill Portage (near Muskrat Falls), MTD 3290 (marsh around small pond). — 4H.

Sedum Rosea (L.) Scop. — 4WH; S. *roseum* (L.) Scop., *Rhodiola Rosea* L.

Saxifraga rivularis L. — 4AH.

S. nivalis L. — 4H.

S. cespitosa L. — 4H; *S. groenlandica* L.

S. aizoides L. Hamilton River: Grand Falls (south side), MTD 3399 (in wet meadow, along brook).

S. oppositifolia L. — 4H.

Mitella nuda L. Hamilton River: Winokapau Lake (Long Point), MTD 3225 (in spruce forest).

Parnassia parviflora DC. Hamilton River: Grand Falls (south side), MTD 3383 (meadow).

P. palustris L. var. **neogaea** Fern. Hamilton River: Grand Falls, MTD 3409 (on rocky, moist shore of river above the falls). — 3WH, 4WH; *P. multiseta* (Ledeb.) Fern.

Ribes lacustre (Pers.) Poir. Hamilton River: Muskrat Falls (portage), MTD 3088a (straggling shrub, in black spruce-*Abies* woods).

R. glandulosum Grauer. Lake Melville: Northwest River, MTD 3061 (behind alder zone along shore); Hamilton River: Muskrat Falls (portage), MTD 3100 (steep sandy slope, among *Alnus*); Winokapau Lake (Long Point), MTD 3228 (clearing around tilt; skunk odor). — 3WH, 4WH; *R. prostratum* L'Hér.

Pyrus decora (Sarg.) Hyland var. **groenlandica** (Schneid.) Fern. Hamilton River: Muskrat Falls (portage), MTD 3086 (in black spruce-*Abies* woods); Grand Falls (south side), MTD 3403 (spruce woods on edge of meadow). — 3WH, 4H; *P. dumosa* (Greene) Fern., ? "*Sorbus scopulina* Graene".

Amelanchier Bartramiana (Tausch) Roemer. Hamilton River: Porcupine Rapids, MTD 3202 (shrub, 5 ft. high; in open place on sandy terrace; recently burned-over forest being replaced by young spruces and *Populus tremuloides*); Winokapau Lake (Long Point), MTD 3233 (moist, rocky, brookside). — 3W, 4WH.

Sibbaldia procumbens L. — 4H.

Potentilla tridentata Ait. Hamilton River: upstream from Muskrat Falls, MTD 3169 (sand binder in dunes along river); Sandy Banks, MTD 3191 (colonizing on newly blown sand). — 3WH, 4WH; *Sibbaldiopsis tridentata* (Soland.) Rydb.

P. palustris (L.) Scop. Hamilton River: upstream from Muskrat Falls, MTD 3176 (around small lake in spruce forest); Winokapau Lake (Long Point), MTD 3234 (willow-bordered swamp along river). — 3WH, 4WH; *Comarum palustre* L.,

P. norvegica L. — 3W, 4W; *P. monspeliensis* L.

P. Crantzii (Crantz) G. Beck — 4A; *P. alpestris* Hall. f.

P. anserina L. — 3H, 4H.

P. Egedei Wormsk. var. **groenlandica** (Tratt.) Polunin — 3W, 4W; *P. pacifica* Howell.

Dryas integrifolia Vahl. — 4WAH.

Geum macrophyllum Willd. — 3W.

Rubus Chamaemorus L. Hamilton River: upstream from Muskrat Falls, MTD 3129 (sphagnum bog); Big Hill Portage (near Humbug Lake), MTD 3306 (sphagnum, tamarack swamp). — 3WH, 4WH.

R. arcticus L. "coll." — 3H, 4H.

R. pubescens Raf. Hamilton River: upstream from Muskrat Falls, MTD 3131 (among rocks along shore); 10 mi. upstream from mouth of Minipi River, MTD 3213 (common, trailing along sandy boulder shores). — 3WH, 4H.

R. acaulis Michx. Hamilton River: Grand Falls (south side), MTD 3388 (rose-colored flowers; meadow).

R. idaeus L. var. **canadensis** Richards. Hamilton River: Muskrat Falls (portage), MTD 3101 (steep, sandy slope; among *Alnus*). — 3WH, 4H.

Sanguisorba canadensis L. Hamilton River: upstream from Muskrat Falls, MTD 3125 (along moist shore, and in crevices among boulders); Big Hill Portage (2.5 mi. from foot), MTD 3250 (recently burned-over forest). — 3W.

Prunus pensylvanica L. f. Hamilton River: upstream from Muskrat Falls, MTD 3182 (on sand dunes along river bank); 10 mi. upstream from mouth of Minipi River, MTD 3212 (gravelly slopes with southern exposure). — 3w.

Trifolium pratense L. — 3w.

T. repens L. — 3WH.

T. agrarium L. — 3W.

Astragalus eucosmos Robins. — 4A.

A. alpinus L. — 4WH.

Oxytropis terrae-novae Fern. — 4WAH; *O. campestris* DC. var. *caerulea* Koch.

Vicia Cracca L. — 3WH.

Lathyrus japonicus Willd. Lake Melville: Northwest River, MTD 3066 (sandy beach above high tide). — 3WH, 4WAH; incl. var. *glaber* (Ser.) Fern., *L. maritimus* (L.) Bigel. MTD 3066 is, in part, typical and in part var. *aleuticus* (Greene) Fern.

Geranium pratense L. — 3WH.

Callitriche palustris L. — 3W.

C. heterophylla Pursh — 4H.

Empetrum nigrum L. Lake Melville: Northwest River, MTD 3054a (dry, sandy soil covered with lichens and a large moss; dominantly black spruce with some white spruce and a few *Larix*, scattered birch and *Salix* rather common); Hamilton River: Big Hill Portage (near Humbug Lake), MTD 3305 (in sphagnum, margin of pond); 5 mi. above Grand Falls, MTD 3339 (trailing over mosses and sphagnum in open black spruce woods). — 3W, 4WH; *E. hermaphroditum* (Lge.) Hagerup.

Acer spicatum Lam. Hamilton River: Gull Island Rapid, MTD 3204 (luxuriant growth of spruces and firs, birch, maple, "*Sorbus*", and *Viburnum*). This appears to be a marked northward range extension.

Viola pallens (Banks) Brainerd. Hamilton River: upstream from Muskrat Falls, MTD 3175 (under willows along river; also around small lake in spruce forest). — 4H.

V. adunca Sm var. **minor** (Hook). Fern. Hamilton River: Grand Falls (south side), MTD 3380 (meadow); Flour Lake, MTD 3425 (along shore in willow-alder zone). — 4WA; *V. labradorica* Schrank.

Epilobium angustifolium L. (typical). Hamilton River: 10 mi. upstream from mouth of Minipi River, MTD 3218 (clearings and on sandy silt slopes, southern exposure). — 3WH, 4WH; *Chamaenerion angustifolium* (L.) Scop.

E. latifolium L. Hamilton River: opp. mouth of Cache River, MTD 3221 (immediately along boulder shore); Winokapau Lake (Long Point), MTD 3231 (boulder shore of river); Grand Falls, MTD 3413 (among rocks along river above the falls). — 3W, 4WH. MTD 3221 is the phase with very narrow leaves.

E. palustre L. *incl.* var. **longirameum** Fern. & Wieg. — 3W, 4H.

E. glandulosum Lehm. var. **adenocaulon** (Haussk.) Fern. Hamilton River: Minipi River (mouth), MTD 3210 (steep gravel, sand and boulder slide). — 3w.

E. alpinum L. Hamilton River: Big Hill Portage (Left-handed Lake), MTD 3257 (open swamp).

E. anagallidifolium Lam. Hamilton River: Grand Falls (south side), MTD 3398 (meadow).

Circaea alpina L. Hamilton River: Big Hill Portage (foot), MTD 3243a (around tilt and in clearing).

Hippuris vulgaris L. Hamilton River: Big Hill Portage (near Humbug Lake), MTD 3317 (in shallow water). — 4H.

These are very slender plants with narrow, short leaves.

H. tetraphylla L. f. — 3w; *H. vulgaris* var. *maritima* (Hell.) Wahl.

Aralia hispida Vent. Hamilton River: upstream from Muskrat Falls, MTD 3168 (along river bank).

Coelopleurum lucidum (L.) Fern. — 3w, 4w.

Ligusticum scothicum L. — 4H.

Conioselinum chinense (L.) BSP. — 4H.

Angelica atropurpurea L. — 3w, 4WH.

Heracleum maximum Bartr. Hamilton River: Muskrat Falls (portage), MTD 3099 (cleared area at top of sand bank 100 ft. high along river). — 3H; *H. lanatum* Michx.

Cornus canadensis L. Lake Melville: Northwest River, MTD 3048 (dry, sandy soil covered with lichens and a large moss; dominantly black spruce with some white spruce and a few *Larix,* scattered birch and *Salix* rather common); Hamilton River: 5 mi. upstream from Grand Falls, MTD 3347 (open black spruce woods). — 2w, 3WH, 4WH; *Chamaepericlymenum canadense* (L.) Asch. & Graebn.

C. suecica L. — 3WH, 4WH; *Chamaepericlymenum suecicum* (L.) Asch. & Graebn.

C. stolonifera Michx. Hamilton River: Muskrat Falls (portage), MTD 3102 (moist places in spruce woods). — 2w, 3w.

Moneses uniflora (L.) Gray. Hamilton River: Muskrat Falls (portage), MTD 3106 (edge of spruce forest); opp. mouth of Cache River, MTD 3224b (spruce forest). — 3w, 4w.

Pyrola secunda L. Hamilton River: Muskrat Falls (portage), MTD 3098 (black spruce-*Abies* woods); Sandy Banks, MTD 3197 (slope covered with mosses, black spruce and fir). — 2w, 3H; incl. var. *obtusata* Turcz. Both typical approaching var. *obtusata* Turcz.

P. minor L. Hamilton River: opp. mouth of Cache River, MTD 3224a (spruce forest). — 3w.

P. virens Schweigger. Hamilton River: Sandy Banks, MTD 3196 (slope covered with mosses, black spruce and fir). — 2w; *P. chlorantha* Sw.

P. asarifolia Michx. (typical) Hamilton River: opp. mouth of Cache River, MTD 3223 (rose at margins of petals; in spruce-fir forest).

P. grandiflora Radius — 4A.

Ledum groenlandicum Oeder. Lake Melville: Northwest River, MTD 3043 (dry, sandy soil covered with lichens and a large moss; dominantly black spruce with some white spruce and a few *Larix* and scattered birch, *Salix* rather common); Hamilton River: 5 mi. upstream from Grand Falls, MTD 3340 (3 ft. high; black spruce woods). — 3w, 4WH.

L. palustre L. var. **decumbens** Ait. — 3H, 4WH; *L. decumbens* (Ait.) Lodd.

Rhododendron lapponicum (L.) Wahlenb. — 4H.

Loiseleuria procumbens (L.) Desv. — 4H.

Kalmia angustifolia L. Lake Melville: Northwest River, MTD 3056 (dry, sandy soil covered with lichens and a large moss; dominantly black spruce with some white spruce, a few *Larix* and scattered birch, *Salix* rather common); Hamilton River: Big Hill Portage (2.5 mi. from foot), MTD 3251 (recently burned-over forest); Big Hill Portage (near Humbug Lake), MTD 3303 (around margin of pond in tamarack swamp); 5 mi. upstream from Grand Falls, MTD 3346 (open black spruce woods). — 2W.

K. polifolia Wang. — 3W, 4WH.

Phyllodoce caerulea (L.) Bab. — 4W.

Andromeda glaucophylla Link (typical). Hamilton River: Big Hill Portage (near Muskrat Lake), MTD 3280 (marsh around small pond).

Chamaedaphne calyculata (L.) Moench. Hamilton River: upstream from Muskrat Falls, MTD 3313 (spruce forest; also in cleared camp area); Big Hill Portage (2.5 mi. from foot), MTD 3248 (recently burned-over forest); 5 mi. upstream from Grand Falls, MTD 3349 (forming zone surrounding small *Eriophorum* bog). — 3W, 4WH.

Gaultheria hispidula (L.) Bigel. Lake Melville: Northwest River, MTD 3080 (spruce and fir woods); Hamilton River: Muskrat Falls (portage), MTD 3091 (sandy soil, black spruce-*Abies* woods); upstream from Muskrat Falls, MTD 3127b (in sphagnum, black spruce-fir forest); 5 mi. upstream from Grand Falls, MTD 3338 (trailing over mosses and sphagnum, open black spruce woods). — 4W; *Chiogenes hispidula* (L.) T. & G.

Arctostaphylos alpina (L.) Spreng. — 3W, 4WH.

Vaccinium uliginosum L. var. **alpinum** Bigel. f. **Langeanum** (Malte) Pol. Lake Melville: Northwest River, MTD 3040 (dry, sandy soil covered with lichens and a large moss; dominantly black spruce with some white, and a few *Larix,* scattered birch with *Salix* rather common); Hamilton River: upstream from Muskrat Falls, MTD 3148 (in rock crevice along river bank); Big Hill Portage (Left-handed Lake), MTD 3261 (open swamp); 5 mi. upstream from Grand Falls, MTD 3341 (up to one foot high, black spruce woods); Grand Falls (south side), MTD 3379 (meadow). — 3W, 4WH; *V. uliginosum sens. lat.*

V. myrtilloides Michx. Hamilton River: Muskrat Falls (portage), MTD 3095 (black spruce-*Abies* woods); Big Hill Portage (Left-handed Lake), MTD 3259 (drier ground, edge of swamp). — 3WH, 4W; ?"*V. pennsylvanicum* v. *myrtilloides* (Michx.) Fern." Fernald, in Gray's Manual ed. 8, p. 1133, gives the range of this species as "Nfld. (local) and e. Saguenay Co., Que., to B. C. ....." the above records thus represent a significant northward range extension.

V. ? vacillans Torr. Hamilton River: 5 mi. upstream from Grand Falls, MTD 3342 (very low; open black spruce woods).

V. angustifolium Ait. Lake Melville: Northwest River, MTD 3055 (dry, sandy soil covered with lichens and a large moss; dominantly black spruce with some white and a few *Larix,* scattered birch with *Salix* rather common); Hamilton River: Big Hill Portage (2.5 mi. from foot), MTD 3247 (recently burned-over forest). — 3H, 4WH; *V. pennsylvanicum* Lam. var *angustifolium* (Ait.) Gray.

V. Vitis-Idaea L. var. **minus** Lodd. Lake Melville: Northwest River, MTD 3047 (dry, sandy soil covered with lichens and a large moss; dominantly black

spruce with some white and a few *Larix,* scattered birch with *Salix* rather common); Hamilton River: upstream from Muskrat Falls, MTD 3174 (sprawling over sand in dunes along river). — 3w, 4wh; incl. *V. Vitis-Idaea sens. lat.*

V. Oxycoccos L. Hamilton River: upstream from Muskrat Falls, MTD 3127a (in sphagnum, black spruce-fir forest), MTD 3177 (in sphagnum close to water around small lake); 5 mi. above Grand Falls, MTD 3348 (trailing over sphagnum and leafy moss; open black spruce woods). — 4wh; *Oxycoccus quadripetalus* Gil.

Diapensia lapponica L. — 3w, 4h.

Primula laurentiana Fern. — 3w, 4wah; *P. farinosa* L. and var. *macropoda* Fern.

P. egaliksensis Wormskj. — 4ah.

Trientalis borealis Raf. Lake Melville: Northwest River, MTD 3078 (spruce and fir woods). — 3wh, 4wh; *T. americana* Pursh.

Armeria labradorica Wallr. — 4wah; *Statice labradorica* (Wallr.) Hubbard & Blake.

Gentiana Amarella L. — 4w.

G. linearis Froel. Hamilton River: Big Hill Portage (near Muskrat Lake), MTD 3283 (marsh around small pond).

Lomatogonium rotatum (L.) Fries — 4h; *Pleurogyne rotata* Griseb.

Menyanthes trifoliata L. var. **minor** Raf. Hamilton River: Big Hill Portage (near Muskrat Lake), MTD 3279 (marsh around small pond); Grand Falls (south side), MTD 3389b (in shallow water of pond).

Mertensia maritima (L.) S. F. Gray. Hamilton Inlet: Indian Harbor, Todd (s.n.) July 20, 1920. — 4w.

Scutellaria epilobiifolia A. Hamilton. Hamilton River: Winokapau Lake (Long Point), MTD 3232 (mouth of brook in moist, rocky spruce forest).

Prunella vulgaris L. var. **lanceolata** (Bart.) Fern. f. **iodocalyx** Fern. Hamilton River: Big Hill Portage (near Humbug Lake), MTD 3314 (on clay and stones, edge of willows by pond).

Galeopsis Tetrahit L. — 3wh.

Mentha arvensis L. var. **villosa** (Benth.) S. R. Stewart f. **glabrata** (Benth.) S. R. Stewart. Hamilton River: Big Hill Portage (foot), MTD 3244 (spruce woods near tilt along brook). — 3w; var. *glabrata* Fern.

Veronica alpina L. var. **unalaschcensis** C. & S. — 4ah; *V. Wormskjoldii* Roem. & Schult.

V. scutellata (L.) (typical). Hamilton River: 7 mi. downstream from foot of Big Hill Portage, MTD 3239 (flowers blue; muddy bank of river).

Castilleja septentrionalis Lindl. Hamilton River: Big Hill Portage (near Humbug Lake), MTD 3319 (in shallow water, tamarack swamp). — 3w, 4a; *C. pallida* (L.) Spreng. var. *septentrionalis* (Lindl.) Gray.

Euphrasia arctica Lange — 4wh.

Bartsia alpina L. — 4a.

Rhinanthus Crista-galli L. — 4w.

Pedicularis flammea L. — 4wh.

P. groenlandica Retz. — 3w.

P. euphrasioides Stephen — 3w, 4wh.

Utricularia vulgaris L. Hamilton River: 7 mi. downstream from foot of

Big Hill Portage, MTD 3237 (in beaver pond); Big Hill Portage (near Humbug Lake), MTD 3300 (pond in tamarack swamp).

Pinguicula vulgaris L. Hamilton River: Sandgirt Lake, MTD 3427 (among rocks in moist mud close to water). — 4WH.

P. villosa L. — 4WAH.

Plantago juncoides Lam. var. **decipiens** (Barnéoud) Fern. — 3WH, 4H; *P. decipiens* Barnéoud, *P. maritima* L.

Galium triflorum Michx. Hamilton River: Grand Falls (south side), MTD 3416 (spruce woods). — 3W.

G. trifidum L. Hamilton River: Winokapau Lake (Long Point), MTD 3229 (bank along river). — 3WH.

G. labradoricum Wiegand — 3W, 4H.

Lonicera villosa (Michx.) R. & S. var. **calvescens** (Fern. & Wieg.) Fern. — 4A.

Linnaea borealis L. var. **americana** (Forbes) Rehder. Lake Melville: Northwest River, MTD 3077 (spruce and fir woods). — 3WH, 4WH; *L. americana* Forbes.

Viburnum edule (Michx.) Raf. Hamilton River: Muskrat Falls (portage), MTD 3104 (in open places of spruce forest). — 3W, 4H; *V. pauciflorum* Raf.

Campanula uniflora L. — 4A.

C. rotundifolia L. — 4A.

Solidago macrophylla Pursh. Hamilton River: Big Hill Portage (Left-handed Lake), MTD 3258 (open swamp); Big Hill Portage (near Humbug Lake), MTD 3318 (in shallow water, edge of pond). — 3W, 4W. MTD 3318 is typical; MTD 3258, var. *thyrsoidea* (Mey.) Fern.

S. multiradiata Ait. Hamilton Inlet: Indian Harbor, Todd (s.n.) July 20, 1920; Hamilton River: opp. mouth of Cache River, MTD 3220 (along bouldery shore). — 4H. Some of the plants with smaller heads in MTD 3220 approach var. *parviceps* Fern.

S. Purshii Porter. Hamilton River: Big Hill Portage (near Muskrat Lake), MTD 3287a (marsh around small pond); Big Hill Portage (near Humbug Lake), MTD 3313 (swampy place along edge of pond in tamarack swamp).

S. lepida DC. — 3W.

Aster puniceus L. var. **laevicaulis** Gray. Hamilton River: Big Hill Portage (foot), MTD 3243b (around tilt and in clearing); Big Hill Portage (near Humbug Lake), MTD 3316 (among willows, edge of pond in tamarack swamp) — *fide* A. Cronquist.

A. radula L. var. **strictus** (Pursh) Gray. Hamilton River: Big Hill Portage (near Muskrat Lake). MTD 3287b (marsh around small pond).

A. foliaceus L. — 3W, 4H.

Erigeron angulosus Gaudin var. **kamtschaticus** (DC.) Hara. — 3W; *E. acris* L. var. *asteroides* DC.

Antennaria canescens (Lange) Malte — 4H.

Anaphalis margaritacea (L.) C. B. Clarke (typical). Hamilton River: Minipi River (mouth), MTD 3209 (in clumps on steep gravel, sand, and boulder slide). — 2W; var. *occidentalis* Greene.

Gnaphalium supinum L. — 4H.

Achillea Millefolium L. Hamilton River: Muskrat Falls (portage), MTD 3108 — sterile. — 3WH, 4WH; incl. var. *nigrescens* E. Meyer.

Chrysanthemum Leucanthemum L. var. **pinnatifidum** Lecoq & Lamotte — 3W.

Artemisia canadensis Michx. — 2W.

A. borealis Pall. (typical). Hamilton River: Sandy Banks, MTD 3193 (in new blown sand of sandy banks).

Petasites palmatus (Ait.) Gray. Hamilton River: Grand Falls (south side), MTD 3373 (wet meadow). — 3W.

P. vitifolius Greene. Hamilton River: Sandgirt Lake (White Rapids), MTD 3430 (swampy place along river at the rapids).

Arnica plantaginea Pursh — 4A.

Senecio congestus (R. Br.) DC. Hamilton Inlet: Indian Harbor, Todd (s.n.) July 20, 1920 — typical. — 4WH; incl. var. *palustris* (L.) Fern., *S. palustris* (L.) Hook.

S. Pseudo-Arnica Less. — 3WH, 4WH.

Cirsium muticum Michx. — 3W.

Leontodon autumnalis L. — 3W.

Taraxacum ceratophorum (Ledeb.) DC. — 4W.

T. officinale Weber — 3W.

T. lapponicum Kihlm. Hamilton River: Grand Falls (south side), MTD 3384 (meadow). — 4AH; "*T. croceum* coll."

Lactuca biennis (Moench.) Fern. — 3W; *L. spicata* (Lam.) Hitchc.

STUDIES OF THE EUPHORBIACEAE, PHYLLANTHOIDEAE I. TAXONOMIC NOTES ON THE WEST INDIAN SPECIES OF PHYLLANTHUS

By Grady L. Webster

During four years of work on a monograph of the West Indian species of *Phyllanthus*, a number of undescribed taxa have been discovered and new interpretations made of some previously known ones. Since publication of the revision may be delayed, it seems advisable to make these notes available now. The species described by Linnaeus, which have been largely misunderstood, will be treated in a subsequent paper and therefore are only mentioned in passing here. Furthermore, there are a number of species whose inclusion in the genus *Phyllanthus* is doubtful; but since most of these cannot be disposed of until generic limits in the Phyllanthoideae are better defined, their treatment must also be deferred.

The studies reported on in this paper were for the most part carried out at the University of Michigan during the preparation of a dissertation under the direction of Dr. Rogers McVaugh, with financial assistance from the Research Club of the University of Michigan and a Horace H. Rackham Fellowship. During 1954 continuation of the work at the Gray Herbarium has been made possible by a National Science Foundation fellowship. With the assistance of many individuals and institutions, either specimens or photographs of the type collections of all the West Indian species have been examined. Photographic negatives of approximately 120 type or isotype specimens are on file at the University of Michigan Herbarium.

The collections cited in this paper have been generously loaned by the curators of the following institutions (herbarium abbreviations the standard ones of Lanjouw and Stafleu, Regn. Veg. 2[1]. 1952): Arnold Arboretum (A); Jardin botanique de l'Etat, Brussels (BR); Chicago Natural History Museum (F); Conservatoire et Jardin botaniques, Geneva (G); Gray Herbarium (GH); Systematisch-Geobotanisches Institut, Universität Göttingen (GOET); Royal Botanic Gardens, Kew (K); Rijksherbarium, Leyden (L); Colegio de La Salle, Vedado, Habana (LS); University of Michigan Herbarium, Ann Arbor (MICH); New York Botanical Garden (NY); Muséum National d'Histoire Naturelle, Laboratoire de Phanérogamie, Paris (P); Naturhistoriska Riksmuseum, Stock-

holm (S); Estación Agronómica de Cuba, Santiago de las Vegas, Habana (SV); United States National Museum, Department of Botany, Washington (US); Naturhistorisches Museum, Vienna (W).

PHYLLANTHUS Linnaeus, Sp. Pl. 981. 1753.

TYPE SPECIES: *P. niruri* L. The arrangement of species is that of the forthcoming revision; the order is considerably modified from that in the last general revision by Mueller (DC. Prodr. 15[2]: 274-436. 1866).

Sect. LOXOPODIUM, sect. nov.

Herbae annuae vel perennes; ramificatione omnino disticha, axillis omnibus floriferis. Stipulae plusminusve auriculatae; folia parva. Flos masculus pedicello articulato, lobis calycis 5 vel 6 parvis, disco ex 5 vel 6 segmentis distinctis; staminibus 3 filamentis liberis vel basi connatis; antheris horizontaliter dehiscentibus; granis pollinis oblongis obscure reticulatis, longitudinaliter 4-sulcatis cum poris aequatorialibus. Flos femineus pedicello brevi geniculato; calycis lobis 5 vel 6; disco integro vel lobato. Ovarium laeve; stylis bifidis. Semina trigona brunnea puncticulate scabridula.

TYPE SPECIES: *P. caroliniensis* Walt. Name of section from Greek *loxos,* crooked, and *podion,* small foot, in allusion to the geniculate fruiting pedicel. This group of perhaps half a dozen species of the New World is characterized by its completely distichous leaves, flowers on all orders of branching, and tetracolporate pollen grains. Old-World species of sect. *Macraea* (Wight) Baill., such as *P. simplex,* are superficially very similar in habit and flowers but have very different pollen grains. Sect. *Loxopodium* is perhaps more closely related to sects. *Urinaria* and *Phyllanthus,* but the species of these two groups differ strongly in habit.

Phyllanthus caroliniensis Walt. Fl. Car. 228. 1788.

This, the most variable and widespread *Phyllanthus* of the New World, ranges from Illinois and Pennsylvania through tropical America to Argentina and Paraguay. In the West Indies it is represented by three subspecies, the typical ssp. *caroliniensis* sparingly introduced as a weed, and the following two native:

Phyllanthus caroliniensis ssp. **guianensis** (Klotzsch) Webster, comb. nov.

P. guianensis Klotzsch, Lond. Jour. Bot. 2: 51. 1843.

Phyllanthus caroliniensis ssp. **saxicola** (Small) Webster, comb. nov.

P. saxicola Small, Bull. N. Y. Bot. Gard. 3: 428. 1905.

Sect. ELUTANTHOS Croiz. Jour. Wash. Acad. Sci. **33**: 12. 1943.

This section, typified by the Mexican species *P. grandifolius* L. (*P. glaucescens* H.B.K.), is represented in the West Indies by six species, the best known of which is *P. nutans* Sw. of Jamaica. The West Indian

species have much smaller leaves and capsules than the Mexican and Central American representatives, and may eventually have to be separated into a separate section.

Phyllanthus nutans Sw. var. trojanus Webster, var. nov.

Folia subtus viridia, venae pallidae. Racemi subterminales axillares, floris solitariis. Columna valde longior quam ramuli stylorum.

TYPE: Jamaica, Trelawny Parish, near Troy, alt. 2,000 ft., slender tree 12—20 ft. high, 2 April 1917, *J. R. Perkins 1331* (GH, holotype).

This striking plant differs from typical var. *nutans* in its green (not red-tinged) foliage and much longer stylar column, but it does not seem distinctly different enough to be given specific rank. It appears to be endemic to the limestone region between Dolphin Head and Troy, while var. *nutans* ranges over the entire island.

Sect. CALLITRICHOIDES, sect. nov.

Habitus *Callitrichearum* et *Peperomiarum* spp.: carnosulus, humilis, ramis patentibus interdum rhizophoris; foliis parvis obovatis, margine cartilagineo-dentatis; floribus parvis, paucis solitariisque axillaribus ad apice ramulorum, inferioribus 1—4 masculis, superiore 1 femineo. Flos masculus calycis lobis 5, obovatis, acutis; segmentis disci reniformibus, purpureis; staminibus 2, filamentis omnino coalitis; antheris extrorsis; granis pollinis globosis, striatis. Flos femineus calycis lobis 6, oblongis vel spathulatis; segmentis disci cuneatis, purpureis; ovario papilloso-scabridulo; stylis suberectis, emarginatis vel bifidis. Capsula parva papilloso-scabridula; seminibus fuscis verruculosis.

TYPE SPECIES: *P. carnosulus* Muell. Arg. This section consists of a single rare species of eastern Cuba, which is unique in its pollen grains and habit. Mueller (DC. Prodr. 15(2): 388. 1866.) placed it in the vicinity of *P. heliotropus, P. hyssopifolius, et al.* (now in sect. *Loxopodium*), but it shows no real affinity to these. Its relations are closest with the species of the next section.

Sect. CYCLANTHERA, sect. nov.

Herbae annuae vel perennes vel suffruticosae, ramificatione more sectionis *Phyllanthi*. foliis vel membranaceis vel coriaceis. Flores solitarii, masculi calycis lobis 5 vel 6, disci segmentis plerumque distinctis; staminibus connatis columnam formantibus; antheris in discum synangiforme omnino connatis et circumscissile dehiscentibus; granis pollinis globosis sexangulatim areolatis; feminei calycis lobis 6; disco 3—8-lobulatis; ovario laeve vel scabridulo; stylis plus minusve bifidis; ramis recurvatis; apice tenuibus. Capsula laevis vel scabridula. Semina atrobrunnea puncticulate scabridula.

TYPE SPECIES: *P. lindenianus* Baill. The epithet of the section is taken from the specific epithet of *P. cyclanthera* Baill., a name which must be rejected because of an unfortunate confusion in its application. Since this group of six West Indian species is well characterized by a

highly modified androecium with the anthers united into a synandrium as in the cucurbitaceous genus *Cyclanthera,* it seems appropriate to conserve Baillon's expressive epithet by having it serve for the entire section.

In addition to the androecium, the peculiar ornamentation of the pollen grains, strikingly similar to that in *Polygonum* sect. *Persicaria,* is diagnostic. The exine is "areolate" as in sect. *Williamia* or sect. *Elutanthos* but the areoles lack a reticulum within. There are also a number of features of habit which set off the members of sect. *Cyclanthera,* particularly the tendency of the leaves at the base of the plant to be much larger than those above and the common production of a single extra leafy axis from the first node of the deciduous branchlet.

Phyllanthus tenuicaulis Muell. Arg. var. **haitiensis** Webster, var. nov.

Ramulis saepe 3—5 cm. longis; nodis 13—20; foliis ellipticis vel late obovatis seu fere orbiculatis, 4—8 mm. longis, 2.5—4 mm. latis; pedicellis floris feminei c. 2 mm. longis; lobis calycis florum masculorum c. 0.9 mm. longis.

TYPE: Haiti, Dépt. Nord-Ouest, Massif du Nord, Anse-à-Foleur, Morne Cheneau, highest part of ridge, c. 800 m., 25 June 1925, *Ekman H4417* (S, holotype).

Phyllanthus inaequifolius Webster, sp. nov.

Suffrutex; ramis primariis erectis, glabris; foliis ramulorum inferiorum insigniter maioribus quam superioribus, membranaceis; synandrio fere sessile; ovario laeve, stylis reflexis adpressis; seminibus c. 1.25 mm. longis, 0.9—1 mm. latis, fuscis, lineis longitudinalibus puncticulatis.

TYPE: Haiti, Dépt. Ouest, Massif de la Selle, Morne Brouet, on dry ridges, 1700 m., 6 August 1924, *Ekman H1344* (S, holotype; US, isotype).

This species, endemic to the southern peninsula of Haiti, has flowers and fruit much like *P. lindenianus* but the habit of *P. berteroanus.* The latter species differs very strongly in its usually coriaceous leaves, very conspicuous purplish disk-segments, and longer fruiting pedicel (5—12 mm.). *P. lindenianus* is much more closely related, but has usually a single main stem, foliage which is not markedly anisophyllous, and scabridulous fruiting pedicels. *P. inaequifolius,* on the other hand, has smooth pedicels 4 mm. long or less, a caudex branching from the base, strongly reduced leaves above, and inconspicuous disk-segments.

Phyllanthus lindenianus Baill. Adansonia 2: 13. 1861-62.

? P. cyclanthera Baill. Adansonia 1: 31-32. 1860-61 (dubious name).

This variable species of Cuba and Hispaniola was treated by Mueller (DC. Prodr. 15(2): 408. 1866.) as *P. cyclanthera* Baill. Unfortunately, that name is a *nomen confusum* and must be rejected. Baillon, misled by the data on the type sheet (from the Pavon herbarium) now in the

Delessert Herbarium, Geneva, published it as a new species from Mexico. Mueller (loc. cit.) corrected this mistake, but seems not to have noticed that the type specimen did not match Baillon's description in the details of its floral morphology. I have examined the holotype and it proves to be the plant currently known as *P. pentaphyllus* Wright, a completely different species belonging to sect. *Phyllanthus.*

Baillon's description of *P. cyclanthera* certainly applies to the Pavon specimens as far as the vegetative organs are concerned, but his description of the male flower is completely different from the male flowers on the sheet:

> "Aucune portion des étamines n'est libre. Au sommet d'une petite colonne cylindrique commune s'étale un connectif horizontal, en forme de plateau circulaire, et les anthères arquées en occupent toute la circonférence. Elles se confondent tellement à leurs extrémités, que, lors de la déhiscence, on ne voit plus qu'une fente horizontale, circulaire, et qu'on pourrait croire à l'existence d'une anthère annulaire unique."

However, the type sheet of *P. cyclanthera* contains no flowers of this kind. The male flowers are borne in pseudoracemes, instead of being solitary as in all species of sect. *Cyclanthera,* and have each two stamens with discrete anthers. Like the vegetative structures, they accord entirely with *P. pentaphyllus* Wright. The paradoxical result is that the type material of *P. cyclanthera* represents an entirely different species from the essential part of the description.

It is difficult to account for Baillon's apparently drawing up a description from two such different elements, unless perhaps some loose flowers of a species of sect. *Cyclanthera* happen to have gotten onto a sheet of *P. pentaphyllus,* and then were not preserved after their dissection. Mueller (loc. cit.) indicated that he saw the type sheet but apparently he did not examine the flowers.

On the basis of a strict interpretation of the type concept one might, perhaps, accept the herbarium specimen as type and thus change the name of the species presently known as *P. pentaphyllus* to *P. cyclanthera.* This, however, would be directly contrary to the intentions of the author of *P. cyclanthera,* for Baillon certainly meant to apply the name to a species with a synandrium in the male flower. This is shown by his comparison of the androecium to that of the genus *Cyclanthera,* his choice of the specific epithet, and his illustration of the male flower in his own "Histoire des Plantes" (5: 150. 1874). The logical conclusion, in my opinion, is to reject *P. cyclanthera* Baill. on the grounds that it cannot be satisfactorily typified.

Fortunately, Baillon published a valid description of the species to which Mueller and others have applied the name *P. cyclanthera.* Most of the reports in the literature under that name may therefore now be

applied to *P. lindenianus* Baill., which becomes the type species of sect. *Cyclanthera.*

Phyllanthus leonardorum Webster, sp. nov.

Annuus, erectus, gracilis; ramis et ramulis fere laevibus, saepe purpurascentibus; foliis parvis, supra plusminusve purpureis; nodo proximo ramulorum saepissime uno flore femineo (non ramulo alio) ferente; floribus parvis, purpureis; pedicellis florum femineorum scabridulis; capsulis c. 2 mm. diam., laevibus; seminibus fuscis, 0.9—1 mm. longis, papilloso-puncticulatis.

TYPE: Haiti, Dépt. Nord-Ouest, vicinity of Jean Rabel, Môle Road, Jan. 27 to Feb. 9, 1929, *E. C. & G. M. Leonard 12624* (GH, holotype; MICH, NY, US, isotypes).

This plant, doubtless closely related to *P. lindenianus,* differs in its more slender habit, smooth purplish stems, and slightly smaller capsules (2.2 vs. 2.5—2.6 mm.). Further study may show that it should be included in *P. lindenianus,* but at present there is not enough evidence to warrant assigning it such a relationship. It is also related to *P. inaequifolius,* so that there is evident a rather puzzling reticulate pattern of relationships among these species of sect. *Cyclanthera* which may be affected by hybridization.

Phyllanthus abditus Webster, sp. nov.

Suffrutex, omnino laevis; foliis membranaceis, plusminusve inter se aequalibus; calyce floris masculi turbinato-constricto, columna staminum conspicua, 0.7 mm. longa; ovario laeve, stylis ascendentibus, gracilibus, breviter conjunctis; seminibus c. 1.25 mm. longis, fuscis, puncticulato-scabridulis.

TYPE: Haiti, Dépt. Sud, Massif de la Hotte, western group, Camp Perrin, northern slope of Morne Vandervelde, on rocks at Source Mare Blanche, c. 700 m., 30 Nov. 1925, *Ekman H5197* (S, holotype).

This unusual species, known only from the type collection, appears to be narrowly endemic to the Massif de la Hotte at the western end of the southern peninsula of Haiti. Its habit is not unlike that of *P. inaequifolius* but it is not noticeably anisophyllous, and its flowers are very different. The elongated staminal column and constricted turbinate base of the male calyx are diagnostic; the male flower is the most gamophyllous of any *Phyllanthus* known to me. The slender erect styles united at the base are distinctive, though somewhat resembling those of *P. inaequifolius,* which is perhaps the nearest congener to the present species.

It seems appropriate to give this plant the epithet *abditus* (Lat., hidden) in allusion to its secretive habitat in the nearly inaccessible interior of the Massif de la Hotte. The epithet may also apply as a comment on its distinguishing characters, inasmuch as these are concealed in the small but very distinctive flowers.

Sect. URINARIA, sect. nov.

Herbae annuae vel perennes, monoicae; ramificatione more sectionis *Phyllanthi;* ramulis ancipitibus; folia subtus hispidula prope marginem, stipulis auriculatis. Flores feminei solitarii ad axillas inferiores; masculi in racemis plurifloribus ad axillas superiores. Flos masculus pedicello articulato, calycis lobis 6 parvis; segmentis disci 6; staminibus 3 liberis connatisve; antheris erectis, extrorsis, longitudinaliter dehiscentibus; granis pollinis subglobosis, 4-sulcatis, subtiliter reticulatis. Flos femineus subsessilis, calycis lobis 6 hispidulis; disco urceolato 6-lobato; ovario tuberculato-papilloso. Capsula tuberculata, seminibus trigonis transverse costatis, plus minusve lateraliter foveolatis.

TYPE SPECIES: *P. urinaria* L.

This section comprises one or two species probably originally native to India, although *P. urinaria* is now widely distributed in the tropics. The tuberculate ovary and the unique transversely barred seeds provide a sharp distinction from herbaceous species of other sections. The branching habit is like that of the species of sect. *Phyllanthus* such as *P. niruri,* but the arrangement of the sexes on the branchlets is exactly reversed.

The name of this group is taken from the *Urinaria Zeylanica, repens, cauliculis rubentibus* of Hermann (Mus. Zeyl., 1717), which is a pre-Linnaean name for *P. urinaria.* The genus *Urinaria,* as maintained by Burmann (Thes. Zeyl. 231. 1737), consisted of two species, one of them (*Urinaria Indica, erecta, vulgaris*) since placed in the synonymy of *P. niruri* L., the other (*Urinaria Indica, supina, cauliculis rubentibus*) now known as *P. urinaria.* Medicus (Malvenfam. 80. 1787) used *Urinaria* as a generic name in an illegitimate sense, i.e., as an outright substitute for *Phyllanthus.* Because of its historical interest, it is appropriate to preserve this old name as the epithet of the section of which *P. urinaria* is the type.

Sect. PHYLLANTHUS

Annual or perennial herbs or slender undershrubs with a distinctive habit, the branching "phyllanthoid": the primary (seedling) axis usually with expanded leaves only near the base, the leaves above reduced to stipule-like cataphylls each of which subtends a leafy, floriferous, deciduous branchlet. Persistent branches appearing in the axils of deciduous branchlets, constructed like the main stem, i.e., bearing spirally arranged cataphylls subtending deciduous branchlets.

TYPE SPECIES: *P. niruri* L.

This section, circumtropical in distribution, includes about 50 or 60 species, many of them superficially extremely similar to one another. Pax and Hoffmann (Natürl. Pflanzenf. 2 ed. 19c: 64. 1931) regarded sect. *Euphyllanthus* as containing about 180 species, but they maintained Mueller's excessively broad circumscription of the group. In the West Indies, sect. *Phyllanthus* is represented by 23 species distributed in three subsections.

Subsect. NIRURI, subsect. nov.

Herbae annuae, monoicae; foliis ad basin inaequilateralibus, stipulis acicularibus; cymulis unisexualibus; staminibus 3 liberis vel infra mediam filamentis connatis; seminibus puncticulate verruculosis.

TYPE SPECIES: *P. niruri* L.

This group comprises a very small number of New-World species. *P. niruri* is the most complex, with many variable populations, while *P. mimicus* of Tobago is a satellite species which may have evolved fairly recently. This subsection differs from the others of sect. *Phyllanthus* in the peculiar 4-colporate heterobrochate pollen grains and puncticulate, not striate or ribbed, seeds.

Phyllanthus niruri L. Sp. Pl. 981. 1753.
Phyllanthus lathyroides sensu Muell. Arg. in DC. Prodr. 15(2): 403. 1866.

This species, although the type of the genus and widespread over all tropical America, has been misinterpreted almost since the publication of the "Species Plantarum". Mueller confused it with *P. swartzii* (see below) and has been followed by all recent authors. *P. niruri* is a very complex species and includes many divergent plants, which often, however, show little clear-cut segregation into populations. In the Caribbean area it is represented by at least two subspecies:

Phyllanthus niruri ssp. niruri.

This, the typical race of the species, is endemic to the West Indies, Barbados being the type locality. It may be distinguished from other subspecies by the pinnately branched midrib of the male calyx-lobes.

Phyllanthus niruri ssp. lathyroides (H.B.K.) Webster, comb. nov.
Phyllanthus lathyroides H.B.K. Nov. Gen. & Sp. 2: 110. 1817.

This subspecies includes the most polymorphic populations of the entire species. It occurs from Texas south to Argentina and Paraguay.

Phyllanthus mimicus Webster, sp. nov.

Herba annua, gracilis. Ramuli ascendentes, 35—40 folia gerentes. Folia oblonga, basi valde asymmetrica, stipulis aciculatibus. Inflorescentia mascula solum unum florem et unam gemmam abortivam gerens; laciniis calycis masculi c. 0.7 mm longis; filamentis liberis. Pedicelli florum femineorum 1.7—2 mm. longi. Semina c. 1 mm. longa, puncticulato-scabridula.

TYPE: Tobago, Big River Bridge, Mason Hall, *W. E. Broadway 3038* (G, holotype; F, S, isotypes). Known only from the type collection. The species derives its epithet from its extraordinary resemblance in aspect to *P. caribaeus* Urb., which also occurs in Tobago. It differs from most forms of *P. niruri* in its slenderer, smaller parts and its branchlets with 35—45 nodes.

Subsect. SWARTZIANI, subsect. nov.

Herbae annuae vel perennes, monoicae; foliis ad basin aequilateralibus, stipulis lanceolatis; cymulis unisexualibus vel bisexualibus; staminibus 2 vel 3, filamentis infra mediam vel per longitudinem connatis; seminibus longitudinaliter striatulis vel carinulatis.

TYPE SPECIES: *P. swartzii* Kostel. This subsection comprises perhaps 20 species distributed in the Americas, Africa, and India. There is a surprisingly close relationship apparent between such American species as *P. swartzii* and *P. abnormis* and Indian species as *P. debilis* and *P. fraternus*.

Phyllanthus stipulatus (Raf.) Webster, comb. nov.

Moeroris stipulata Raf. Sylva Tellur. 91—92. 1838.

Phyllanthus diffusus Klotzsch, Bot. Voy. Herald 105. 1853.

TYPE: mountains of Jamaica, *Swartz* (S, holotype). This species, which prefers moist habitats, occurs over much of tropical America. The evidence for adopting the name of Rafinesque will be presented in the paper on the Linnaean species of *Phyllanthus*.

Phyllanthus swartzii Kostel. Allg. Med. Pharm. Fl. 5: 1771. 1836 (as *P. swarzii*).

Phyllanthus niruri β genuinus sensu Muell. Arg. in DC. Prodr. 15(2): 406. 1866; **non** *P. niruri* L.

TYPE: Jamaica, *Swartz* (S, holotype). This is the commonest annual species of *Phyllanthus* in the American tropics and in much of the Old World. Due to the interpretation of Mueller, it has most often been confused with *P. niruri*, but it is not rarely confounded with other species as well. The nomenclatural history of this species will be taken up with that of *P. stipulatus*.

Phyllanthus fraternus Webster, sp. nov.

Phyllanthus niruri β scabrellus Muell. Arg. Linnaea 32: 43. 1863; not *P. scabrellus* Webb, as to type.

TYPE: India, Punjab, Tummooghat, Ravee-Chenab Doeb, Oct. 1846, *Thomas Thomson* (K, holotype).

This plant, presumably native to India, has been very sparingly introduced into the West Indies. I have seen only three collections from this area: Bermuda, *Collins 225* (F, NY, US); Cuba, El Salado [Pinar del Río?], *Wright 1675* ex p. (NY, US; this collection number of Wright's a mixture of *P. fraternus*, *P. procerus*, *P. swartzii*, and *P. tenuicaulis*); Barbados, *W. Wright* (BR, annotated by Mueller as *P. Niruri β genuinus*).

P. fraternus derives its name from its close resemblance to *P. swartzii*, with which it has very often been confused. It differs, how-

ever, in its unisexual inflorescences, scabridulous branchlets, and spathulate fruiting calyx-lobes. The two species are indubitably rather closely related, even though one is native to India and the other to the West Indies.

Subsect. PENTAPHYLLI, subsect. nov.

Herbae vel suffrutices, monoicae vel dioicae; foliis ad basin aequilateralibus; stipulis cataphyllorum cordato-auriculatis; cymulis unisexualibus, femineis unifloribus; staminibus 2 vel 3, liberis vel connatis; seminibus longitudinaliter striatulis.

TYPE SPECIES: *P. pentaphyllus* Wright ex Griseb.

This group of between 15 and 20 species appears to be essentially endemic to the Caribbean area, with perhaps one or two outlying species in Venezuela and in Brazil; none occur in Mexico or Central America. Subsect. *Pentaphylli* resembles subsect. *Swartziani* in the characters of seeds and pollen grains, but is distinguished from both the other subsections by vegetative characters. The cataphyllary stipules are reddish, often almost black, usually indurate and conspicuously auriculate. In some species the terminal axis is abortive just above the cotyledons as in *Euphorbia* subg. *Chamaesyce*, so that several branches become clustered at the thickened tip. This process may be repeated in the branches, so that the plant will consist of fascicles of branches spreading from knot-like nodes, with long internodes between. In other species the primary axis is not abortive and the plants have the habit of species of the two other subsections.

Phyllanthus amnicola Webster, sp. nov.

Suffruticulus, dioicus; ramulis hispidulis; foliis infra hispidulis, marginibus revolutis, 3—6 mm. longis; cymulis masculis paucifloribus; flos masculus calycis lobis 6 obovatis 0.7—0.9 mm longis; staminibus 3; filamentis infra mediam connatis; flos femineus calycis lobis 6, obovatis albo-marginatis 1—1.2 mm. longis; seminibus c. 1.1 mm. longis.

TYPE: Dominican Republic, Prov. Monte Cristi, Monción, at the junction of the Río Cenobí and Río Cenobicito, edge of stream, c. 700 m., 20 June 1929, *Ekman H12936* (S, holotype; US, isotype).

This species is vegetatively distinctive because of the hispidulous thickenings on the undersurface of the revolute leaves and the branches rooting at the nodes. It appears to be related to *P. buchii* Urb. on the basis of floral characters, but this suggestion must be regarded as only tentative.

Phyllanthus micranthus A. Rich. in Sagra, Hist. Nat. Cuba 11: 216. 1850; Muell. Arg. in DC. Prodr. 15(2): 412. 1866.

The typical form of this species (ssp. *micranthus*) is a rare plant

restricted to the pinelands of the Sierra Maestra range in Oriente province, Cuba. Female flowers and fruit are still unknown and much to be desired.

Phyllanthus micranthus ssp. **fuertesii** (Urb.) Webster, comb. nov.

Phyllanthus fuertesii Urb. Repert, Sp. Nov. **13**: 451—452. 1914.

TYPE: Dominican Republic, prov. Barahona, prope Barahona in collibus apricis 275 m. alt., 1912, *Miguel Fuertes 561* (F, G, GH, NY, S; syntypes).

This taxon is still not clearly defined in spite of the fact that a rather considerable number of herbarium specimens are available. Characteristically, it differs from ssp. *micranthus* in being monoecious rather than dioecious, annual rather than perennial, and in having 3 stamens rather than 2. Unfortunately, none of these characters holds and there appears to be no justification for maintaining the two taxa as distinct species.

Phyllanthus procerus Wright, Anal. Acad. Ci. Habana 7: 149. 1870.

TYPE: Cuba, Pinar del Río, *Wright 3684* (GH, holotype; NY, S, isotypes). This species has often been confounded with *P. micranthus*, to which it was reduced as a synonym by Urban (Repert. Sp. Nov. **13**: 452. 1914). However, it is undoubtedly distinct. The peculiar styles of *P. procerus*, which are modified to resemble the arms of a Maltese Cross, are diagnostic; and the very broad male calyx-lobes (often broader than long) are equally so. There is some chance for confusion in the fact that the type collection, *Wright 3684*, is a mixture of *P. procerus* and *P. maestrensis* Urb. The specific epithet may, in fact, have been derived from the latter element. The description of the flowers clearly applies to *P. procerus,* however, so that the element with introrse anthers (*P. maestrensis*) can be excluded.

Phyllanthus pentaphyllus Wright ex Griseb. Goett. Nachr. 1865: 167. 1865.

This very widespread Caribbean species, which is native from southern Florida to Curaçao and Venezuela, presents a number of taxonomic difficulties. It is broken up into many isolated populations whose relationship and systematic importance are difficult to assess. The most important variants appear to be the following:

Phyllanthus pentaphyllus ssp. **pentaphyllus.**

The typical subspecies comprises two varieties which scarcely differ in anything more than inflorescence.

Phyllanthus pentaphyllus var. **pentaphyllus.**

The type specimen, *Wright 1939* (Herbarium Grisebachianum, GOET), is a depauperate plant with membranous leaves, evidently col-

lected on rocks inland, and probably — from indirect evidence — in the Cajálbana area of Pinar del Río, Cuba. It appears very different from other plants growing on coral platforms along the coasts of Cuba and Hispaniola, but there is not a single stable morphological character which might distinguish them. The scattered forms from the southern Caribbean could perhaps, on a population basis, be designated as varieties, but it would be impossible to make out a satisfactory key. The Guadeloupe form (*P. polycladus β guadeloupensis* Urb. Symb. Ant. 1: 333. 1899) differs in its woodier, stiffer stems and rounder leaves, and may perhaps eventually be maintained. The plants from Curaçao, however, appear in no way different from those of Cuba.

Phyllanthus pentaphyllus var. **floridanus** Webster, var. nov.

A varietate *pentaphyllo* differt floribus utriusque sexorum in plantis diversis vel ramulis diversis.

TYPE: Florida, Monroe Co., Big Pine Key, open pineland on coral rock, 3 August 1950, *Wilbur & Webster 2551* (MICH, holotype; isotypes to be distributed).

Phyllanthus pentaphyllus ssp. **polycladus** (Urb.) Webster, comb. nov.

P. polycladus Urb. Symb. Ant. 1: 333. 1899.

Phyllanthus imbricatus Webster, nom. nov.

Phyllanthus nanus Millsp. Bull. Torr. Bot. Club 43: 464—465. 1916; not *P. nanus* Hook. f. Fl. Br. Ind. 5: 298. 1887.

Section NOTHOCLEMA, sect. nov.

Frutices vel arbusculae, monoicae vel dioicae, ramificatione more sectionis *Phyllanthi:* ramulis folio bipinnato similibus; foliis membranaceis vel chartaceis, acutis acuminatisve. Flos masculus pedicello glabro vel hirsutulo; calycis lobis 6, biseriatis, apicibus saepe reflexis, disco aut cupuliforme aut ex segmentis 3 reniformibus; staminibus 3; filamentis coalitis, antheris sessilibus, horizontaliter dehiscentibus; granis pollinis globosis, echinulosis, echinulis clavatis. Flos femineus pedicello gracile, interdum hirsutulo; calycis lobis 6 iis masculis subsimilibus; disco cupuliforme; stylis fere liberis, patulis, gracilibus vel apice dilatatis, bifidis vel laceratis. Capsula prominenter venosa; seminibus plano-convexis, laevibus.

TYPE SPECIES: *P. acuminatus* Vahl. The sectional epithet (from Greek *nothos*, spurious; *klema*, branch) alludes to the resemblance of the leafy branchlets to compound leaves or fern fronds.

This group of approximately 10 species is restricted to the New World, with its center of diversity in South America. In some species (including *P. acuminatus*) the branchlets first produced by an expanding branch may be simple rather than bipinnatiform, and variation in

the number of lateral axes occurs. However, the floral characters of the section, especially the peculiar male disk and pilate pollen grains, are distinctive.

Section CICCOPSIS, sect. nov.

Frutices vel arbusculae, verisimiliter monoicae, plusminusve cauliflores; ramificatione more sectionis *Phyllanthi;* stipulis cataphyllorum persistentibus, induratis, non reflexis; foliis chartaceis, ellipticis ovatisve, venis subtus prominulis, marginibus non revolutis. Flos masculus calycis lobis 6 integris, ex parte media valde recurvatis; segmentis disci 6 foveolatis; staminibus 3 liberis, antheris pronum deflexis, subhorizontaliter dehiscentibus; granis pollinis globosis, 3-sulcatis, subtiliter reticulatis. Flos femineus pedicello longo, calycis lobis 6 integris, subpatulis; lobis disci 3 laevibus non foveolatis; ovario laeve; stylis liberis, patulis, bifidis. Fructus ignotus.

TYPE SPECIES: *P. pseudocicca* Griseb.

This section appears to be monotypic, consisting only of the narrowly endemic type species in eastern Cuba. Phylogenetically it is highly interesting, for it appears to be a relict group which has arisen from near the base of the *Phyllanthus*-complex. In aspect, *P. pseudocicca* resembles *P. physocarpus* of Africa and may well be closely related to it, although technically the latter falls into sect. *Anisonema* because of its 5 stamens united into two sets. The Cuban species also resembles the common Asiatic cultivated species *Cicca acida* (L.) Merr., and the two species of the South American genus *Aporosella.* Both of these genera differ by virtue of their 4-merous flowers, and the latter has dioecious inflorescences and no floral disk.

Sect. WILLIAMIA (Baill.) Muell. Arg. Linnaea **32**: 2. 1863.

Phyllanthus discolor Poepp. ex Spr. Syst. 3: 21. 1826.

This species widespread in Cuba is of especial interest because of its presumably primitive male flowers. There are normally about 13 stamens united so that the anthers are arranged in three tiers, though the number may vary from 10 to 15. No other American species has such a high number. Although the species is variable, only one local population warrants special recognition:

Phyllanthus discolor var. **pallidus** (Wright ex Griseb.) Webster, comb. nov.

Phyllanthus pallidus Wright ex Griseb. Gött. Nachr. **1865**: 168. 1865.

Although maintained at specific status by Mueller (Prodr. **15**(2): 328. 1866), no constant morphological characters can be found to support such an interpretation. The type collection, *Wright 1950* (GOET, holotype; G, GH, isotypes) from the Cajálbana region in Pinar del Río, is strikingly different from most forms of var. *discolor* because of its

very broad nearly deltoid pale subcoriaceous leaves and subsolitary flowers. But even in the type locality there are transitions between this and the typical form with ovate darker thinner leaves and several flowers at a node.

Section WILLIAMIANDRA Griseb. Gött. Nachr. 1865: 171. 1865.

Phyllanthus mirificus sp. nov.

Monoicus, versimiliter suffrutex; ramis ramulisque lenticellis conspicuis praeditis; foliis ramulorum oppositis, coriaceis, ellipticis, emarginatis, 1.7—2.8 cm. longis. Flores ad axillas comosi: masculi lobis calycis 5, coriaceis, 1.5 mm. longis; staminibus 5 in columnam coalitis, antheris biseriatis superioribus 3, inferioribus 2, longitudinaliter dehiscentibus; granis pollinis globosis, areolatis; feminei lobis calycis 6 biseriatis, coriaceis, integris; disco plano, angulato. Ovarium ab apicibus expansis stylorum conjunctim late conicis tectum.

TYPE: Cuba, Oriente, Charrascal del Coco south of Moa, July 1945, *Bros. León, Clemente, & Alain 22613* (MICH, holotype; LS, isotype). The holotype is the only collection seen.

This apparently very rare species from the botanically fascinating Moa region of eastern Cuba is the most surprising novelty encountered during the study of the West Indian species. The opposite leaves of the branchlets and the stylar calyptra at once distinguish *P. mirificus* from all of its West Indian congeners. The peculiar androecium, of five stamens united in two unequal sets, is exactly like that of the Old-World section *Anisonema.* However, the pollen grains of that section, at least in the few species examined, are very different from those of *P. mirificus*. It is probable that the closest relative of the new species is *P. excisus* Urb., and the type collection was originally determined as that species. Because of its similarity to *P. excisus* and the other species of sect. *Williamiandra, P. mirificus* seems best included there, although it may eventually have to be made the type of a monotypic section.

Sect. ORBICULARIA (Baill.) Griseb. Fl. Br. W. Ind. 34. 1859.

This group can under no circumstances be considered a distinct genus, at least not unless it is removed from *Phyllanthus* in combination with sects. *Williamia* and *Williamiandra.* Even then it would be impossible to delimit such a genus; and there are other groups included in *Phyllanthus* which are more distinctive. The species of sect. *Orbicularia* comprise a taxonomically difficult complex, within which specific lines become obscured apparently by means of both hybridization and differentiation.

Sect. ASTERANDRA (Klotzsch) Muell. Arg. Linnaea 32: 2. 1863.

The widespread West Indian representative of this section has, since Mueller's treatment in 1866, been designated as *P. grandifolius* L. However, as will be pointed out in the forthcoming paper on the Linnaean species of *Phyllanthus*, this is incorrect:

Phyllanthus juglandifolius Willd. Enum. Hort. Berol. Suppl. 64—65. 1813.

Phyllanthus grandifolius sensu Muell. Arg. in DC. Prodr. 15(2): 329. 1866; not *P. grandifolius* L.

Sect. OMPHACODES, sect. nov.

Frutices vel arbusculae, monoicae; ramificatione more sectionis *Phyllanthi*, ramulis ex parte in ramis penultimis brevissimis congregatis; foliis magnis vel permagnis, plerumque chartaceis vel coriaceis; floribus axillaribus, femineis solitariis, masculis pluris ad axillas; flore masculo calycis lobis 5, obovatis vel orbicularibus, integris; segmentis disci 5 liberis vel laeviter connatis; staminibus 3; filamentis connatis; antheris liberis, subsessilibus, horizontalibus vel ascendentibus, loculis divergentibus; granis pollinis globosis, areolatis; flore femineo pedicello longo, gracile, calycis lobis 5 deciduis; disco annulato, undulato; stylis fere liberis, patulis, bifidis, ramis divergentibus; capsula subglobosa extrinsecus carnosa muris crassis, coccis non elasticiter dehiscentibus; semina trigona, laevia, brunnea.

TYPE SPECIES: *P. subcarnosus* Wright ex Muell. Arg. The name alludes to the resemblance of the fruit to a green grape.

This section of two or three West Indian species appears to be allied to sect. *Ciccopsis*, which it resembles in its spur-shoot habit, tendency to cauliflory, and slender bifid styles. However, the pollen grains of the two sections are very different. On the other hand, sect. *Omphacodes* resembles sect. *Asterandra*, which has areolate pollen grains, rather similar fruit, and monadelphous stamens, but differs in its dilated styles and dendroid habit.

Sect. THAMNOCHARIS, sect. nov.

Frutices vel arbusculae, monoicae; ramificatione more sectionis *Phyllanthi*; foliis ovatis ellipticisve, coriaceis; stipulis ramorum magnis coriaceis persistentibus, ramulorum scariosis caducis; floribus axillaribus in cymulis bisexualibus; flore masculo calycis lobis 4—6 subintegris, ovatis vel suborbicularibus; segmentis disci 4—6 liberis, crassis, foveolatis; staminibus aut 2 aut 5 vel 6, filamentis connatis [vel interdum liberis?]; antheris liberis, longitudinaliter dehiscentibus, loculis divergentibus; granis pollinis globosis, areolatis; flore femineo pedicello superne angulato vel dilatato, 4—14 mm. longo; calycis lobis 4—6 coriaceis integris; disco annulato 4—6-angulato, foveolato tenuiusculo; stylis liberis vel connatis, ramis divergentibus teretibus tenuibus; capsula subglobosa in siccis non venosa; semina trigona atrobrunnea, laevia vel rugulosa.

TYPE SPECIES: *P. cinctus* Urb. Name from Greek *thamnos*, shrub, and *charis*, grace; the aspect of the plants attractive and strange.

This group of three Cuban species belongs among the series of sections with 4-parted male calyces and 2 or 3 stamens, as interpreted by Mueller (DC. Prodr. 15[2]: 278. 1866). Pax and Hoffmann (Natürl. Pflanzenfam. 19c: 65. 1931) assigned *P. cinctus* to sect. *Eriococcodes*

on the basis of its 2 stamens and 5- or 6-parted female calyces. However, the type species of sect. *Eriococcodes, P. acutissimus* Miq., differs from the Cuban plants in its very different persistent stipules, thinner acuminate leaves, unisexual inflorescences, dorsally carinate calyx-lobes, and verruculose ovary. Final disposition of the groups allied to sect. *Eriococcodes* cannot be made until the Indomalaysian species of *Phyllanthus* have been thoroughly studied. It is probable that Mueller's dependence on number of flower-parts as distinguishing characters has resulted in many distantly related plants being brought close together, for it is apparent that reduction in number has often proceeded independently in different groups of the genus.

Sect. *Thamnocharis* is itself not an entirely homogeneous group, for the newly described *P. comptus* is very different from the other two species in a number of particulars. Following Mueller's system, it would have to be referred to an entirely different part of the genus because of its 6 stamens. Nevertheless, the resemblances in habit, flower structure, and especially the caducous stipules, indicate that all three species are probably rather closely related.

Another species which somewhat resembles those of this section, at least in habit, is *P. chryseus* Howard, a plant endemic to the Moa region of eastern Cuba, where *P. cinctus* also grows. However, it differs fundamentally in its persistent stipules, revolute leaves golden beneath, unisexual inflorescences, massive annular male disk, horizontally dehiscing anthers, dilated lacerate styles, and deeply fissured black seeds. For the present, *P. chryseus* may be referred to sect. *Epistylium,* with which it agrees in its palm-like habit, persistent stipules, and dilated styles; but eventually it may have to be separated into a distinct section.

Phyllanthus cinctus Urb., Symb. Ant. 9: 191—192. 1924, in part (excl. descr.).

Conami (?) *ovalifolia* Britton, Mem. Torr. Bot. Club 16: 73—74. 1920; not *Phyllanthus ovalifolius* Forsk., 1775.

Phyllanthus brittonii Alain, Contr. Mus. La Salle 11: 1. 1952.

TYPE: Cuba, Oriente, between Yamurí and Bermejal, February 1911, *Shafer 8446* (NY, holotype).

Phyllanthus ekmanii Webster, nom. nov.

Phyllanthus cinctus Urb., Symb. Ant. 9: 191—192. 1924, in part (as to description, not as to type); Alain, Contr. Mus. La Salle 11: 1. 1952.

TYPE: Cuba, Oriente, Sierra de Nipe ad Río Piloto locis rupestribus cr. 750 m. alt., 18 August 1914, *Ekman 2523* (S, holotype; NY, isotype).

Alain (loc. cit.) has pointed out that Urban confused the plant from the Sierra de Nipe with the one collected by Shafer from further east.

It is true that when Urban transferred Britton's species to *Phyllanthus* his appended description was based not on Britton's plant but on specimens collected by Ekman in the Sierra de Nipe. Alain therefore has applied the name *P. cinctus* to the plant collected by Ekman, and renamed the other *P. brittonii.* However, Urban specifically cited *Shafer 8446* as the type of *P. cinctus,* and the new code of botanical nomenclature (1952 ed., article 65) expressly states that when a transferred epithet has been applied incorrectly it must be retained for the plant on which it was originally based. Since *Shafer 8446* is also the type of *P. brittonii* Alain, there is no alternative to making this name a synonym of *P. cinctus.*

As a result of this confusion, the plant from the Sierra de Nipe still requires a name, and it seems appropriate to name it in honor of Erik Leonard Ekman, one of the most distinguished of West Indian plant collectors. *P. ekmanii* is so closely related to *P. cinctus* that their having been confused is not surprising, and the two might perhaps be considered allopatric subspecies of a single species. Alain has suggested that the two species are distinct on the basis of floral characters which, however, I am unable to verify. He characterizes his *P. brittonii* [*P. cinctus* Urb.] as having anthers united by their connectives and his *P. cinctus* [*P. ekmanii* Webster] as having them free from one another. In the flowers which I have examined the anthers are discrete in *P. cinctus* and fused from one-third to their entire length in *P. ekmanii.* Possibly this character is inconstant and should not be relied upon. But the anthers are differently shaped (deltoid in *P. cinctus,* lanceolate in *P. ekmanii*), and *P. ekmanii* has much larger calyces. These differences appear to justify the maintenance of specific status for both taxa.

Phyllanthus comptus Webster, sp. nov.

Verisimiliter frutex, omnino glaber; stipulis cataphyllorum lanceolatis induratis deciduis 6—7.5 mm. longis; ramulis plerumque 7—14 cm. longis, laevibus, 4—7-foliatis; stipulis foliorum ramulorum scariosis caducis 5—6 mm. longis. Folia coriacea ovata vel elliptica, obtuse apiculata, 2.5—5 cm. longa, supra nitidiuscula, venis prominulis, marginibus subrevolutis. Flos masculus [ex alabastro notato] calycis lobis 6 (5) late ovatis; segmentis disci 6 (5) liberis, foveolatis; staminibus 6 (5); filamentis verisimiliter liberis (sed columna staminum nondum adulta?); antheris erectis, sulcis ad apicem confluentibus. Flos femineus pedicello fructifero 10—14 mm. longo, lobis calycis 5 vel 6, spathulatis; stylis fere liberis, ascendentibus, bifidis, ramis gracilibus. Semina asymmetrica atrobrunnea vermiculate rugulosa.

TYPE: Cuba, Pinar del Río, en arroyos, La Cajálbana, La Mulata, September 28, 1952, *J. Acuña 18222* (SV, holotype; fruiting). Male flowers described from a later collection near the type locality, *J. Acuña & Bernice Schubert 19120* (GH).

This very distinct and localized species receives its epithet from the decorative ornamentation of the seed. It is one of the most interesting of the many endemic species found in the Cajálbana region of western Cuba. A considerable number of these endemic species have, like *P. comptus,* vicarious relatives in Oriente, so that the Cajálbana is a region of extraordinary botanical interest. We are indebted to Ing. Julian Acuña, Director of the Experiment Station at Santiago de las Vegas, Havana, for the knowledge of this very interesting plant. Dr. Acuña not only discovered the original station, but made a special return trip to secure the male flowers.

The vegetative structure of this species, especially the caducous stipules, indicates that it is related to *P. cinctus* and *P. ekmanii.* The flowers, however, are strikingly different, for the stamens in *P. comptus* are 6 (rarely 5) and apparently free instead of 2 and monadelphous, the calyces are 6- (rarely 5-) parted, and the styles are free, not united into a column as in the other two species. The vermiculate pattern of the seed also sharply distinguishes *P. comptus* from the smooth seeds of *P. cinctus* and *P. ekmanii.* Nevertheless, the totality of characters strongly suggests that the three species must be related, even though their separation into two groups is an ancient one.

Sect. HEMIPHYLLANTHUS (Muell. Arg.) Muell. Arg. Flora 1865: 370. 1865; DC. Prodr. 15(2): 323. 1866.

TYPE SPECIES (lectotype): *P. ovatus* Poir. The four species included in this section by Mueller actually belong in as many different sections. Of the two species originally included when the group was described as a section of *Glochidion* (Muell. Arg. Linnaea 32: 59, 71. 1863), *P. ovatus* accords somewhat more closely with the sectional character and hence is chosen as the type.

Croizat (Jour. Wash. Acad. Sci. 33: 12. 1943) has rightly objected to the return of this group to *Glochidion* as was done by Pax and Hoffmann (Natürl. Pflanzenfam. 19c: 58. 1931). The united styles of the various American species included in sect. *Hemiphyllanthus* do not indicate their affinity with *Glochidion* or indeed with one another. Stylar union is only one of many characters which undergo parallel or convergent evolution in different groups of *Phyllanthus.*

As here emended, sect. *Hemiphyllanthus* comprises 6 species of Hispaniola and the Lesser Antilles characterized by tree-fern habit, reddish-tomentulose axes, bipinnatiform branchlets, and areolate pollen grains.

Phyllanthus megapodus Webster, sp. nov.

Frutex monoicus 3—5 m. alt.; ramulis folio bipinnato similibus; axibus penultimis subglabratis 20—40 cm. longis, nodiis 6—17; stipulis cataphyllorum lanceolatis acuminatis auriculatis induratis dense rufo-tomentulosis, *c.* 2.5—4 mm.

longis; axibus ultimis floriferis laevibus 5—18 cm. longis, nodiis 13—27; stipulis euphyllorum lanceolatis acuminatis denticulatis deciduis, 1—1.8 mm. longis; foliis oblongis obovatisve subfalcatis, 12—30 mm. longis, marginibus planis. Flos masculus calycis lobis 5 ellipticis obovatisve integris, c. 2—2.5 mm. longis; segmentis disci 5 subreniformibus tenuibus integris; staminibus 3, filamentis connatis, columna c. 0.5 mm. longa; antheris subsessilibus, loculis divaricatis, horizontaliter dehiscentibus. Flos femineus pedicello fructifero ad basin tenue, superne carnoso magnopere dilatato; calycis lobis 5 erectis valde imbricatis ellipticis ovatisve subcarnosis, c. 2.3 mm. longis; disco obscuro; stylis erectis omnino coalitis, columna carnosa quam ovario major. Semina [ex fragmenta notata] c. 3 mm. longa, rufo-brunnea.

TYPE: Martinique, *Sieber flor. martin. 396* (W, holotype; BR, G, L, P, isotypes). The specific epithet refers to the greatly enlarged and fleshy pedicel of the female flower, which at anthesis is broader than the calyx.

This very rare species is known only from one other collection: Dominica, Hampstead, *Lloyd 640* (F, NY). Mueller (DC. Prodr. 15[2]: 381. 1866) briefly referred to it as *P. mimosoides* [lusus] *macrophyllus*, apparently regarding it as an abnormal form of the common Lesser Antillean species *P. mimosoides* Sw. However, although the male flowers in both plants are very similar, the female flowers are completely different. Those of *P. mimosoides* have slender pedicels and scarcely modified styles united only 1/3 their length or less. Furthermore, the species differ vegetatively, the branchlets of *P. megapodus* having fewer nodes and larger leaves.

CONTRIBUTIONS FROM THE GRAY HERBARIUM
OF HARVARD UNIVERSITY

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In the temperate to cold area of South America south of about latitude 20 is found a group of plant species variously referred to five different genera, *Menonvillea, Hexaptera, Dispeltophorus, Decaptera* or *Cymatoptera.* A detailed study of these species shows they have many characteristics in common and really form an integrated group that should be included in a single genus. There are various explanations as to why such a solution to the relationships of the species involved has not been previously put forward. Perhaps the most important point is that a monographic study of the group has not heretofore been undertaken. The several genera were described during a period when inadequate material was available and even publications were not widely disseminated. Botanists of the period (1820-60) often were guessing at the identity of newly arrived material from South America and redescribed genera already published without establishing with certainty the novelty of their plants. *Dispeltophorus* and *Cymatoptera* have long been discredited as having been superfluous when proposed. Equally significant has been the tendency to seize upon a single character and use that as the basis for segregating genera. Thus, Turczaninow proposed *Decaptera* to accommodate plants with ten-winged fruits which differed from *Hexaptera* only in having four additional wings beyond the six normally present.

Garaventa (1950) has ably shown that *Decaptera* does not differ from *Hexaptera* in any essential character and, therefore, may not logically be maintained as a distinct genus. Specimens with ten-winged fruits have turned up in several collections otherwise of the six-winged type. In fact, he suspects that *Decaptera* was based on one of these. Actually, partially developed secondary wings (Plate 3, Fig. 2) are not infrequently seen on specimens of various species, suggesting that the presence or absence of additional wings may not be of marked taxonomic significance. Individuals bearing ten-winged fruits have been seen in *Menonvillea cuneata, M. spathulata,* and *M. Hookeri,* verifying the observations of Garaventa (l. c.).

Perhaps the most radical departure from previous treatments is the inclusion of *Hexaptera* in *Menonvillea* in the present work. Several facets of evidence point to the conclusion that the species involved form a single genus, not two genera. Outstanding features of the group of species as a whole are (a) the fact that the valves of the fruits are nearly closed; (b) the valves are basically triangular in cross section; (c) wings are present, principally at the margins of the valves (absent or modified in some species); (d) there is a single ovule present, attached by a long funiculus inserted well up to the top of the replum; and (e) the silique is borne on a gynophore. *Menonvillea* was described as having wings only in the lateral position produced from the margins of each loculus. The silique was supposed to be tetrapterous. In *Hexaptera*, as the name implies, the complete fruit has six wings. As compared to the silique of *Menonvillea*, there is in *Hexaptera* an additional wing in the dorsal position midway between the lateral margins of each valve. (Plate 2, Fig. D). This dorsal wing is adjacent to the main vein of the valve. In *Menonvillea* (sens. strict.), often there is a callus of varying thickness and sculpturing present in the same dorsal position (Plate 5, Fig. 3) and this sometimes has a rudimentary wing atop. The ten wings of the fruits of some plants are accounted for by a further extension of wing development on siliques that are basically the same as the tetrapterous or hexapterous types. Here a secondary wing is present between each of the lateral wings and the dorsal midwing of each valve adding four, usually less well developed wings, to the whole silique. In reviewing the history of *Hexaptera* and *Decaptera*, it became quite clear that the main character used to distinguish them from *Menonvillea* was that of wing number.

In describing *Hexaptera*, Hooker (1830) pointed to the linear petals of *Menonvillea*, in addition to the absence of dorsal wings on the valves of the fruit, as being distinctive. *Hexaptera* was supposed to possess at least spatulate if not broader petals. However, in such taxa as *M. purpurea* (Plate 4, Fig. B, C, D), (*Hexaptera linearis* Barn.), and *H. constitutionis* F. Phil., in which the fruits are hexapterous, the petals are definitely linear. Furthermore, in these species all other characters, including such minute ones as the nature of the nectaries and the markedly saccate outer sepals, are more nearly in accord with the type species of

Menonvillea than with that of *Hexaptera*. The complete breakdown of these purportedly distinctive characters makes necessary the elimination of *Hexaptera* as a genus and the placing of the species heretofore referred there into the older *Menonvillea*. In studying the *M. linearis* complex, I have found it difficult to maintain the hexapterous *M. purpurea* as a species distinct from *M. linearis*. This is decisive evidence that a single genus is represented by these two species formerly placed in *Hexaptera* on the one hand and *Menonvillea* on the other. Even *M. linearis*, the type species, has a strong tendency toward hexapterous fruits. This may be seen in the abbreviated wings present in the dorsal position on the siliques of a collection made by Dr. Otto Buchtien at Valparaiso in 1895, as represented at the Botanical Museum, Stockholm, the Gray Herbarium, and the United States National Herbarium.

Cymatoptera has never gained acceptance because it was so obviously proposed without an adequate consideration of *Menonvillea*. Turczaninow repudiated it himself when he renamed his own *Cymatoptera chilensis* as *Menonvillea media*. *Dispeltophorus* is almost in the same category with *Cymatoptera*, having been proposed without consideration of *Menonvillea*. *D. crassifolius*, the only species ascribed to this genus, is quite obviously only *Menonvillea linearis*. *Decaptera* has been used to a limited extent, but there is no doubt now that no real basis exists for keeping the name in use. With *Hexaptera*, *Decaptera*, *Dispeltophorus*, and *Cymatoptera* disposed of as synonyms, *Menonvillea* becomes an intelligible genus characterised by a distinctive fruit which, in superficial characteristics, reminds one of the fruits of certain Umbelliferae. The fruit is highly modified in contrast to the relatively simple silique of most genera of the Cruciferae. There has obviously been strong reduction in the length of the siliques as indicated by the position of the attachment of the funiculus to the replum which, in these fruits, is above the area of the valve, usually almost a centimeter up the style. In all of the fruits I have opened there is but a single seed present in each valve, and there is no evidence that more than a single ovule is formed. The siliques are indehiscent, and the valves are almost completely closed. Each valve drops away from the closed replum independently, the seed remaining within the valve. The winged valve, comprising one half of the silique, is adapted to wind dispersal.

Acknowledgements

I have been aided in this study especially by the generous loans of material by Directors and Curators of herbaria in Europe, South America, and the United States. Specimens have been cited according to the abbreviations of Lanjouw and Stafleu (1954). The loan of Philippi types from the Museo Nacional de Historia Natural in Santiago de Chile has been particularly helpful. Dr. Román Perez Moreau has made critical specimens and photostats of some determinations of O. E. Schulz available, for which I wish to thank him publicly. The plates were drawn by Dorothy H. Marsh and by Beatrice Tugendhat, to whom I wish to express my appreciation.

Taxonomic Treatment

Menonvillea D.C., Systema 2: 420. 1821

Hexaptera Hook., Bot. Misc. **1**: 350. tab. 72-74. 1830.
Dispeltophorus Lehm., Ind. Sem. Hort. Hamb. 1836. no. 2.
Decaptera Turcz., Bull. Soc. Nat. Mosc. **19**: 497. 1846.
Cymatoptera Turcz., Bull. Soc. Nat. Mosc. **27**: 309. 1854.

Annual or perennial herbs; aerial stems erect to decumbent, some species with both aerial and subterranean stems; leaves basal and cauline or in some species only cauline leaves present; stems and leaves glabrous to densely pubescent with simple or branched trichomes; inflorescences racemose, loose to dense; sepals glabrous to densely pubescent, usually scarious-margined, nonsaccate, or the outer pair saccate with the inner pair nonsaccate, or all four saccate; petals white, purplish or yellowish (not a clear yellow), broadly spatulate to linear; stamens tetradynamous, all free or the paired stamens variously united; siliques stipitate, usually winged; valves indehiscent, enclosing the seed, opening against replum narrow and slit-like, nearly the height of the valve or reduced in some species to a very small opening just large enough to permit the funiculus to pass through to the replum; wings virtually absent, or 4, 6, or 10; replum very narrow, the margins often somewhat fused; septum absent in most species, very much thickened and scarcely recognizable as a septum in others; style evident, mostly stout; stigma massive in most species; seeds marginless, plump, single in each loculus; cotyledons incumbent to accumbent.

Type species: *Menonvillea linearis* DC.

KEY TO THE SPECIES

A. Plants with deep fleshy or ligneous branching underground stems, perennial, caespitose and tufted caudex branches; leaves crowded on branches that usually originate below ground, often cuneate; siliques usually 6-winged, sometimes 10-winged.

B. Valves of silique unequal; aerial stems markedly suffrutescent and densely covered with old leaf-bases; leaves rigid, entire and acute at apex..... ..... 1. *M. cicatricosa.*

B. Valves of silique equal or nearly so; aerial stems herbaceous or barely suffrutescent and without old leaf-bases (old leaf-scars often evident on subterranean stems); leaves various.

C. Leaves spatulate to broadly obovate, mostly obtuse or truncate, usually pubescent, petiolate.

D. Trichomes of leaves retrorse or absent; leaves relatively large, 1—3 cm. long, tridentate or rarely entire; siliques without lateral ribs or rarely with lateral ribs present; plants not markedly condensed.

E. Siliques 8—13 mm. long, wings 1.5—3 mm. wide; leaves entire and oblong to oblanceolate (*M. macrocarpa*), or three-lobed and broadly cuneate (*M. rigida*).

F. Leaves entire, oblong to oblanceolate; wings of siliques thin, easily collapsed. ..... 2. *M. macrocarpa.*

F. Leaves three-lobed, broadly cuneate; wings of siliques rigid .... 3. *M. rigida.*

E. Siliques less than 8 mm. long, wings ca. 1 mm. wide; leaves dentate (except in some plants of *M. virens*).

G. Leaves obovate (6—) 8—12 mm. wide, narrowing abruptly from blade to petiole; trichomes tawny, short; infructescences capitate ..... 4. *M. virens.*

G. Leaves cuneate, 4—6 (—8) mm. wide, narrowing gradually from blade to petiole; trichomes white, longer than above; infructescences elongate (*M. cuneata*) or capitate (*M. Nordenskjoeldii*).

H. Infructescences elongate, elevated well above subjacent leaves; leaves and stems densely and uniformly pubescent 5. *M. cuneata.*

H. Infructescences capitate, barely exceeding and closely invested by subjacent leaves; leaves and stems rather sparsely pubescent (with long trichomes) to nearly glabrous .... 6. *M. Nordenskjoeldii.*

D. Trichomes of leaves ascending; leaves small, 6—10 mm. long, entire; siliques with lateral ribs; plants densely caespitose ..... 7. *M. spathulata.*

C. Leaves linear, acuminate, glabrous, sessile ..... 8. *M. frigida.*

A. Plants with a tap-root, annual, biennial or perennial, caudex unbranched or rarely branched; leaves various, not tufted nor upon branches originating below ground; siliques usually 4- or 6-winged, sometimes 10-winged, wings occasionally rudimentary or wanting.

I. Valves of the siliques dorsally concave, ventrally convex; plants annual, low.

J. Petals 6—8 mm. long; basal leaves crowded, spatulate to cuneate; siliques sparsely hirsute, 4—5 mm. long by 4—4.5 mm, broad ..... 9. *M. Comberi.*

J. Petals less than 4 mm. long; basal leaves few or none, leaves pinnatifid; siliques glabrous, 2—3 mm. long.

K. Wings well developed and reflexed from replum, narrow and sinuous above and below; valves separated laterally by a thickened replum; petals 2.5 mm. long ..... 10. *M. alyssoides.*

K. Wings rigid, not highly developed, not forming a deep, nearly enclosed cup; sinuses above and below broad and open; valves separated laterally by the usual narrow replum; petals ca. 1.5 mm. long ..... 11. *M. patagonica.*

I. Valves of the siliques dorsally convex or flat, never concave, usually with a ventral ridge; plants annual to perennial.

L. Basal leaves petiolate, blade at least five times the width of the petiole and usually much broader; paired stamens united at least below (except in *M. hirsuta*).

M. Leaves pinnately lobed, occasionally sinuate-dentate; flowering stems exceeding the basal leaves; cauline leaves present.

N. Siliques densely hirsute with large simple trichomes; stems mostly decumbent ..... 12. *M. hirsuta.*

N. Siliques glabrous; stems mostly erect.

O. Siliques ovate in outline, narrowed above, less than 4.5 mm. long; basal leaves 2—3 dm. long ..... 13. *M. longipes.*

O. Siliques orbicular in outline, not narrowed above, 5—10 mm. long; basal leaves 0.5—1.5 dm. long.

P. Basal leaves with ovate or broadly oblong segments to deeply sinuate-dentate, rachis of leaf-blades broadly oblanceolate, often wider; styles 2 mm. long or less.

Q. Petals less than half again as long as the sepals, spatulate; infructescences elongated; plants mostly above 2 dm. high. ..... 14. *M. Hookeri.*

Q. Petals more than twice as long as the sepals, linear to linear-spatulate; infructescences condensed; plants mostly less than 2 dm. high. ..... 15 *M. scapigera.*

P. Basal leaves with linear segments, rachis of leaf-blades linear, similar to the segments in width; styles over 2.5 mm. long. ..... 16. *M. perstylosa.*

M. Leaves dentate; flowering stems usually exceeded by the basal leaves; cauline leaves absent. ..... 17. *M. famatinensis.*

L. Basal leaves absent or not strongly differentiated into blade and petiole; if present, then blade area less than five times the width of the petiole area; paired stamens free. ..... R.

R. Petals linear, thickish, narrower at apex than at widest point near middle; anthers distinctly oblong; pedicels spreading at right angles to slightly recurved, 2—5 mm. long.

S. Sepals (at least the outer pair) markedly saccate, linear-oblong, 5—8 mm. long; buds oblong; filaments terete, slender, exceeding sepals by one third of their length or more.

T. Siliques 6-winged, glabrous or sparsely covered with bulb-shaped trichomes; plants definitely perennial.

U. Leaves spatulate, obtuse, petiolate; pedicels 2.5—5 mm. long; infructescense dense. ..... 18. *M. constitutionis.*

U. Leaves linear, accuminate, not differentiated into blade and petiole; pedicels 1—2.5 mm. long; infructescence fairly lax ..... 19. *M. purpurea.*

T. Siliques 4-winged, (in *M. linearis* there is a well developed central, dorsal callus, which rarely has a rudimentary wing present atop; also bulb-shaped trichomes are present around the callus); plants annual or perennial.

V. Siliques longer than broad, dorsal callus or calluses prominent; glands petaloid.

W. Leaves pectinate; rachis gyrate; wrinkled valves with 2 calluses, one on each side of dorsal central axis ..... 20. *M. pinnatifida.*

W. Leaves entire or 3-parted; rachis not gyrate; valves with 1 callus, usually not wrinkled, central on the dorsal axis ... 21. *M. linearis.*

V. Siliques orbicular; dorsal callus not present; glands not petaloid.

X. Stems and the rachis of the infructescence flexuose; fruiting pedicels slender, divaricately ascending; leaves narrow, single at the node ..... 22. *M. flexuosa.*

X. Stems and the rachis of the infructescence straight or nearly so; fruiting pedicels stout, slightly recurved; leaves thick, several to the node. ..... 23. *M. crassa.*

S. Sepals nonsaccate, obovate to broadly spatulate, < 3 mm. long; buds broadly obovate; filaments flattened or terete, barely exceeding or shorter than the sepals to longer than the sepals.

Y. Plants floccose-tomentose, tending to be stout and ligneous at base; main stem markedly gyrate; pedicels stout: leaves terete. fleshy. ..... 24. *M. orbiculata.*

Y. Plants greenish, sparsely pubescent; annuals without a tendency to become ligneous; main stem usually non-gyrate; pedicels slender; leaves mostly flat, scarcely fleshy.

Z. Siliques wingless to narrowly winged, longer than broad, with pronounced lateral calluses, usually wrinkled .... 25. *M. chilensis.*

Z. Siliques broadly winged, orbicular, wings 1—1.5 mm. wide; calluses absent. ..... 26. *M. alata.*

R. Petals obovate to broadly spatulate, thin, broader at apex than near middle; anthers oval, scarcely oblong; pedicels divaricate to ascending, 5—12 mm. long.

a. Siliques wingless; valves nearly round, flattened only on inner face, outer surface irregularly ridged and grooved, 1.5 mm. in diameter ... 27. *M. minima.*

a. Siliques winged; valves flattened parallel to wings except for the callus, outer surface not ridged and grooved but with a central conspicuous callus present, 3—5 mm. in diameter.

b. Wings crinkled; callus of valves with a marked constriction below, rudimentary wing at top and bottom of callus not developed; petaloid nectaries acuminate ..... 28. *M. Gayi.*

b. Wings smooth; callus of valves without a constriction below, a rudimentary wing developed above and below callus; petaloid nectaries blunt. ..... 29. *M. litoralis.*

1. **Menonvillea cicatricosa** (Philippi) Rollins, comb. nov.

Hexaptera cicatricosa R. A. Philippi, Anal. Univ. Chile **2:** 442. 1862.

Perennial with a much elongated caudex, suffrutescent; caudex branched, stramineous, occasionally up to 2 dm. long, nearly covered with persistent leaf-bases; leaves all alike, petiolate, not forming a basal rosette but occurring densely along the stems for 4-6 cm., rather thick and fleshy, pubescent with simple appressed trichomes or glabrous, spatulate, abruptly tapered at apex to form a sharp point, 1-1.5 cm. long, 5-8 mm. wide; stems 1-2 dm. high, flowering portion of stem sparsely pubescent with simple trichomes, striate, stramineous; inflorescence ca. 1 dm. long; pedicels slender 1.5-2 cm. long, divaricately ascending, hirsute with slender simple trichomes; sepals nonsaccate, scarious-margined, sparsely pubescent, ca. 2 mm. long, ca. 1.5 mm. wide; petals linear (spatulate), broadest ca. 0.5 mm. below apex, 5-6 mm. long, ca. 1 mm. wide; stamens free; siliques glabrous, maximum length ca. 12 mm., hexapterous, stipitate, gynophore expanded upward, ca. 3 mm. long; seed chamber ca. 6-8 mm. high, ca. 5 mm. wide, wings 3-5 mm. wide, 1-2 mm. wide on underdeveloped side of silique, coarsely erose along margin; valves with an inner orifice extending from top to bottom; styles 3-4 mm. long, stigmas not markedly expanded; immature seeds wingless, brown, ca. 4 mm. long, 3 mm. wide; cotyledons accumbent.

Chile: Type in the herbarium of the Museo Nacional de Historia Natural, collected at San José, Prov. del Maule, 1861—62, *H. Volckmann* (SGO, photo. at GH). Other specimens examined: San José (K)[1]; Prov. of Curico, 1841. *Bridges 1119* (BM, K); Cordilleras above Colchagua, Jan., 1930, *Anastasio Pirion 138* (GH).

The lower portion of the inflorescence shows numerous sterile flowers in all of the plants seen. The developed fruits are at or near the apex of the inflorescence in each plant where they are present. The leaves on some of the plants of the Bridges collection are rather densely pubescent but wholly glabrous on others. The presence of pubescence is not strictly correlated with the age of the leaves, for plants in flower may be either pubescent or glabrous. Trichomes are present on the stems, pedicels, and calyces of all plants studied. There is a peculiarity of the fruit of *M. cicatricosa* that may or may not be genetic. In all of the fruits I was able to examine, only one of the two locules had a seed present. The other locule was not only sterile but also much smaller in all dimensions than the fertile locule, including the wings. The result is a very "lop-sided" silique. If, as appears probable, this reduction is consistent, it is probably genetic and represents one step further in silique reduction than I have seen in other crucifers.

Two minor taxa seem to be represented by the available material of this species. The Bridges and the Pirion specimens, both in flower, have broadly spatulate to obovate instead of linear petals as found in the other specimens, and the anthers are at least half again as long as in the type series. With so few specimens to study and no chance for field observations, the significance of these differences and others that would probably be found with more adequate material for comparison cannot be determined.

Menonvillea cicatricosa has a well developed suffrutescent aerial stem densely covered with hardened leaf-bases. The green parts of the plant are elevated well above the ground level, and it is the intervening stem area that bears old leaf-bases. *M. cicatricosa* has large fruits with broad wings and entire leaves. In these characters it resembles *M. macrocarpa.* However, the suffrutescent aerial

1) There are no further data upon this specimen except "Herbarium Chilense. purchased of Mr. E. C. Reed, Dec. 1873." The single plant is so similar to the type that I could not find even minor differences. It seems probable that this Kew specimen is actually an isotype.

stems are distinctive as are the thick rigid leaves. The species is to be associated with *M. macrocarpa*, but the relationship does not appear to be very close.

2. **Menonvillea macrocarpa** (Johnston) Rollins, comb. nov.

Hexaptera macrocarpa I. M. Johnston, Contrib. Gray Herb. 85: 166. 1929.

Perennial; root deep, thick (1-2 cm.), woody and gnarly; underground stems well developed; aerial stems several to numerous, lax, branched, herbaceous, hirsute with small spreading trichomes, tawny or purplish below, greenish above, 1-2 dm. high; basal leaves absent; cauline leaves crowded, entire, sessile, oblong to oblanceolate or narrowly elliptical, acute with a small callosity at apex, 6-15 mm. long, 3-5 mm. broad, uniformly pubescent with numerous spreading or retrorse simple trichomes, greenish to somewhat paler; inflorescence racemose, lax; pedicels slender, erect to slightly spreading, hirsute, 1-1.5 cm. long; sepals pubescent, linear-oblong, ca. 4 mm. long, 1.5 mm. wide; petals spatulate, yellowish white, 5-6 mm. long, 1.5-2 mm. wide, not markedly differentiated into blade and claw; siliques stipitate, broadly elliptical to orbicular, 10-13 mm. long, 9-11 mm. wide, valves pubescent, elliptical, purplish, 5-6 mm. long, wings hyaline, thin, 2-3 mm. wide, sinus above deep and narrow, sinus below shallow to absent, stipe 1-2 mm. long; style thick, ca. 3 mm. long; ovules 1 in each loculus; seeds wingless, ca. 4 mm. long, ca. 2.5 mm wide; cotyledons accumbent. Plate 1, Fig. A-D.

Chile: Prov. Atacama, Dept. Vallenar, diluvial gravels at lower end of lake, Laguna Valeriano, ca. lat. 29° 3′ S., long. 69° 52′ W., January 8—10, 1926, *Ivan M. Johnston 6058* (GH, type; K, isotype). Known only from the type collection.

In fruit size this species compares with *M. rigida*, but in other characteristics the two are very different, as shown by the characters given in the key. I suspect *M. macrocarpa* is actually most closely related to *M. cuneata*, a species it resembles in habit. The root of *M. macrocarpa* is large and woody and quite obviously carries the plant through periods of adverse growing conditions. The numerous scars present on the upper portion of the roots indicate that the stems die down periodically.

As shown in Plate 1, the wings of the siliques are paper thin. These are collapsed and somewhat irregular on the dried specimens.

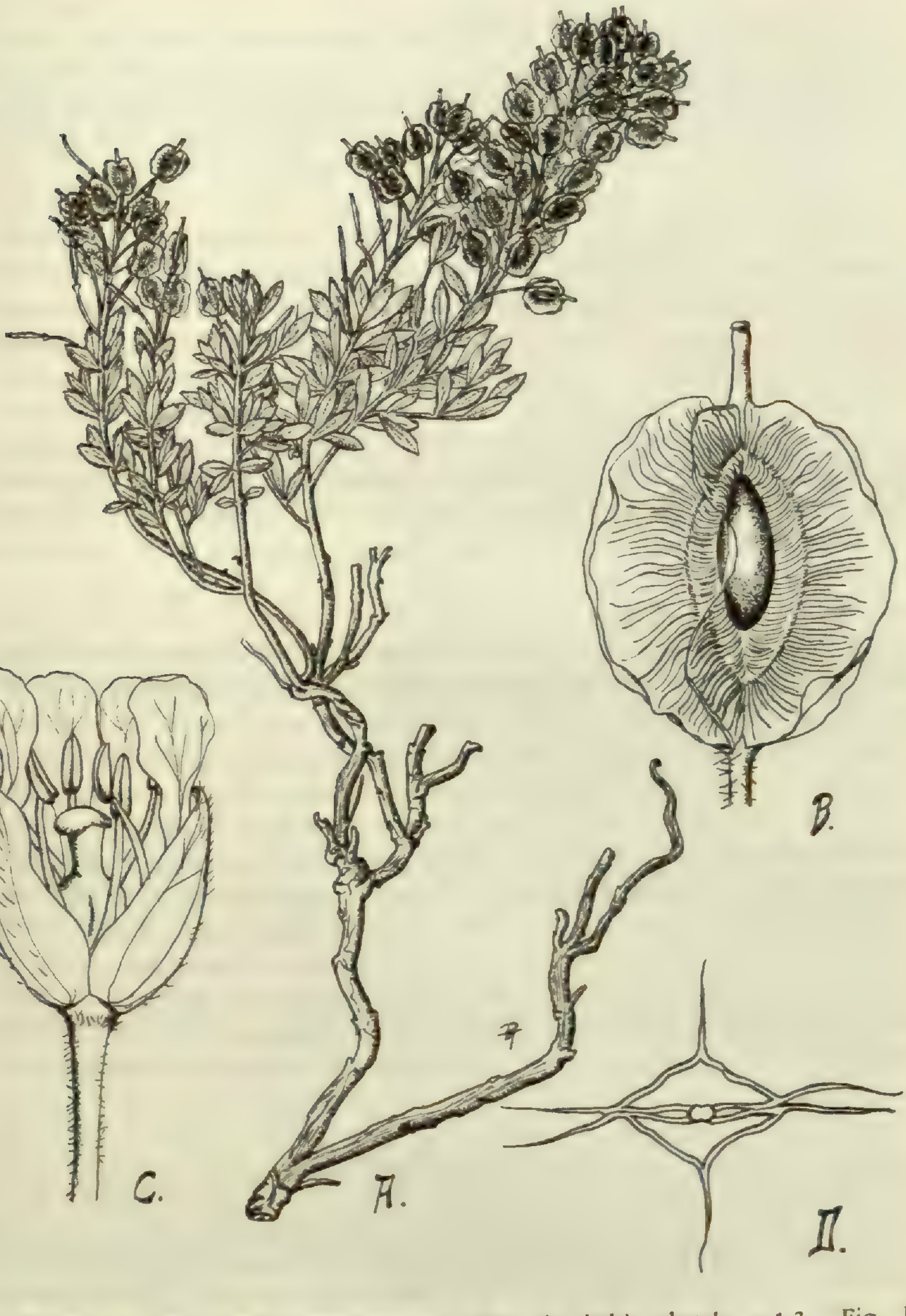

PLATE 1. *Menonvillea macrocarpa.* Fig. A, habit sketch, x 1.3. Fig. B, silique, x 3.5. Fig. C, flower, x 6. Fig. D, cross section of silique, x 5. Drawn from the type, *Johnston 6058*.

3. **Menonvillea rigida** Rollins, sp. nov.

Perennial with long fleshy branching underground stems and erect aerial stems, underground portions up to 6 dm. long and bearing numerous leaf-scars, aerial portions densely clothed with numerous overlapping leaves, simple or branched, 2-10 cm. high, hirsute with simple white trichomes ca. 0.2 mm. long; leaves broadly cuneate, 1-1.5 cm. long, 5-10 mm. wide, densely overlapping to produce a ball-like cluster at the ends of branches or a dense mass below the inflorescence, densely pubescent with simple white retrorse trichomes, three-lobed with the two lateral lobes equalling or exceeding the central lobe, lobes erect, obtuse; infructescence crowded, racemose, 4-6 cm. long; pedicels stout, widely spreading, 1.5-2 cm. long, densely pubescent with spreading simple trichomes; sepals oblong, nonsaccate, densely pubescent, hyaline-margined, 4-5 mm. long, 2-2.5 mm. wide; petals white, broadly spatulate with a narrow claw, ca. 6.5 mm. long, 2-3 mm. wide; filaments expanded at base; siliques with 6 rigid wings, stipitate, oval to orbicular, 9-11 mm. long, 8-10 mm. wide, valves purplish, densely pubescent with spreading trichomes, wings 1.5-2 mm. wide, apical sinus broad, 1-1.5 mm. deep, sinus absent or only faintly seen below; stipe stout, 2-3 mm. long; style stout, ca. 2 mm. long, stigma not exceeding the style in diameter; ovules single in each loculus; seeds plump, slightly longer than broad, ca. 4 mm. long, ca. 3 mm. broad; cotyledons accumbent.

Herba perennis; caulibus dimorphis hypogaeis et epigaeis; caulibus hypogaeis horizontalibus carnosis glabris; caulibus epigaeis erectis hirsutis 2-10 cm. longis; foliis late cuneatis 3-lobatis imbricatis dense pubescentibus; infructescentiis racemosis densis 4-6 cm. longis; pedicellis divaricatis crassis pubescentibus 1.5-2 cm. longis; sepalis oblongis non saccatis dense pubescentibus 4-5 mm. longis, 2-2.5 mm. latis; petalis albis late spathulatis ca. 6.5 mm. longis, 2-3 mm. latis; siliquis rigidis stipitatis ovalibus vel orbicularibus pubescentibus hexapteris 9-11 mm. longis, 8-10 mm. latis; alis rigidis; stylis crassis ca. 2 mm. longis; seminibus ca. 4 mm. longis, ca. 3 mm. latis; cotyledonibus accumbentibus.

Argentina: Gob. Neuquén, Arroyo Manzana, "collected by a native, Opazo, for Mr. Comber", Andes Expedition 38°—41° S., 1925—27, *H. F. Comber 1130* (K, type; GH, photo.); Sierra Mamuil Malal, Gob. Neuquén, December 12, 1926. *H. F. Comber 922* (K).

In habit, *Menonvillea rigida* is very much like *M. Nordenskjoeldii*. Both species have very long underground fleshy stems that often branch to produce surface tufts of leaves at a distance of a decimeter or more from each other. These relatively long underground stems maintain a similar diameter often for a distance of several decimeters. These extensive fleshy underground

parts appear to be well adapted to shifting soils. *M. rigida* has much larger fruits than *M. Nordenskjoeldii*, and the pubescence on stems and leaves is markedly different. The simple trichomes on the leaves and stems of *M. rigida* are dense, evenly spaced, and tend to be somewhat retrorse. In *M. Nordenskjoeldii*, the trichomes are much longer and tend to be arachnoid when abundant enough. However, in the latter species, the leaves are often nearly glabrous. Notes accompanying *Comber 922* give some indication of the nature of *M. rigida*. These notes read, "perennial with long fleshy stems and roots from among loose stones. Flowers white, scented, leaves fleshy, soft, green."

4. **Menonvillea virens** (Phil.) Rollins, comb. nov.

Hexaptera virens R. A. Philippi, Anal. Mus. Nac. Chile (Bot.) No. 8. sec. 2: 6. 1891.

H. cuneata, var. *famatinensis* Hieron. ex Hoss., Bol. Acad. Nac. Cien. Córdoba **26**: 98. 1921. Nomen.

Deep rooted perennial; underground stems extensively developed, rhizome-like, fleshy, irregular in diameter, dark brown or black in dried specimens, aerial stems branching abruptly from the thicker underground stems well below ground surface, numerous, lower portions usually underground, sparsely leafy below, becoming densely leafy above, 4-12 cm. long; leaves entire to apically dentate with 3-5 teeth, broadly obovate to broadly oblanceolate, abruptly narrowed from blade to petiole, truncate to obtuse at apex, 1.5-3 cm. long, 8-15 mm. wide, densely pubescent with short spreading or reflexed trichomes, more or less investing the inflorescence; infructescence nearly capitate, dense; lower pedicels reflexed, middle group at right angles, upper erect, pedicels hirsute to more softly pubescent, slightly curved, terete to slightly flattened, 8-12 mm. long; sepals oblong, pubescent, hyaline-margined, 4.5-5.5 mm. long, ca. 2 mm. wide; petals white, spatulate, 7-9 mm. long, 2-3 mm. wide; siliques nearly sessile, leathery, six-winged, slightly longer than broad, 5-6 mm. long, 4-5 mm. wide, glabrous to pubescent over the valves; wings rather thick, usually less than 1 mm. wide; stipe less than 1 mm. long; styles thick, 2-2.5 mm. long; seeds plump, 2-3 mm. long, 1.5-2 mm. wide; cotyledons accumbent. Plate 2, Fig. A-D. Northern Chile and Northwestern Argentina at high elevations.

Argentina: PROV. JUJUY: Cerro Tuzzle, Dept. Susques, *Cabrera 8365* (LP); Tilcara, Dept. Tilcara, *Venturi 6748* (US). PROV. SALTA: Nevado del Cajón, *Rodriguez 1399* (LP). PROV. TUCUMÁN: Cumbres Calchaquies, *Castillon 2504* (LIL); Tafi, *Castillon 283* (LIL); Aconquija, *Rohmeder s.n.* (LIL); Estancia Santa Rosa,

PLATE 2. *Menonvillea virens*. Fig. A, habit sketch, x ½. Fig. B, silique, x 5. Fig. C, flower, x 5.5. Fig. D, cross section of silique, x 6. Drawn from *Castillon 3361*.

Chicligasta, *Venturi 9231* (US). PROV. CATAMARCA: San Francisco, El Hoyito, *Schreiter 6092* (LIL); Cumbres del Negro Ara, El Cajón, *Castillon 3361* (LIL); Negro Muerto a Reales Blancos, *Schreiter 6109* (LIL); Dept. Santa Maria, *Venturi 6609* (US); El Cajón, *Rodriguez 1399* (GH, LIL). PROV. RIOJA: Cueva de Perez, Sierra Famatina, *Hieronymus & Niederlein 377* (G, GH, K); La Vega de La Mesada, *Kurtz 13929* (CORD); Ampallado, *Bodenbender 15862* (CORD); Filo Baio, Dept. Famatina, *Rohmeder 29355* (LIL); Las Trancas, Cerro Coloradito, Dept. Lavalle, *Kurtz 14583* (CORD).

Chile: PROV. TARAPACÁ: Machuca a Copacoya, Feb. 18, 1885, *F. Philippi 1838* (SGO, type; photo. of type, GH; photos of isotype from Berlin, F, GH).

There are slight differences between separated populations of *Menonvillea virens*, especially as regards the quantity and nature of the pubescence and the shape and margin of the leaves. I can see minor constant differences in the length of the trichomes between populations of different areas, and in some the trichomes are crooked while in others they are straight. The type of *M. virens* has entire leaves, and there is only a suggestion of three lobes on two leaves of the isotype at Berlin; but in the populations of Tucumán and Catamarca 3-5 dentate or lobed leaves predominate in the material.

Several attempts were made to associate various of these minor characters with geographic location or area, but in each instance correlations that seemed to have taxonomic significance could not be established.

Actually, *M. virens* comes very close to *M. cuneata* on the one hand and to *M. Nordenskjoeldii* on the other. The plants of *M. virens* combine very broad and abruptly tapering leaves with a capitate infructescence, which in most instances barely exceeds the longest leaves. The trichomes of *M. virens* are much shorter and more tawny than those of *M. cuneata.* Most specimens of *M. virens* are dark, due in part, at least, to the dark pubescence.

5. **Menonvillea cuneata** (Gill. & Hook.) Rollins, comb. nov.

Hexaptera cuneata Gill. and Hook., Bot. Misc. **1**: 352, t. 74 [as cuneifolia]. 1830.

H. cuneata, var. *violacea* (Phil.) Reiche, Anal. Univ. Chile **90**: 88. 1895.

H. Jussiaei Barn. in Gay, Fl. Chile **1**: 179, t. 5. 1844.

H. Jussiaei, var. *tridens* (as tridenta) Reiche, Anal. Univ. Chile **90**: 88. 1895.

H. violacea R. A. Phil., Anal. Univ. Chile **41**: 673. 1872.

H. tridens Phil., Anal. Mus. Nac. Chile, Bot. No. 8, sec. 2; 6. 1891.

H. Kurtzii Hosseus, Bol. Acad. Nac. Cien. Córd. **26**: 97. 1921. Nomen.

Decaptera trifida N. Turczaninow, Bull. Soc. Nat. Mosc. **19**: 497-8. 1846.

Perennial from a deep root system; caespitose, underground stems branched, fleshy to slightly woody, straw-colored to purple; aerial stems simple or branched, canescent to greenish, densely pubescent, rarely less pubescent, 1-2 (-3) dm. high; leaves all cauline, numerous and overlapping, cuneate, tridentate to nearly three-lobed, rarely entire, 1-2 cm. long, 4-10 mm. wide, densely pubescent with simple reflexed trichomes, usually canescent; inflorescence dense, elongating in fruit; pedicels divaricate, densely hirsute, 6-12 mm. long; sepals oblong, hyaline-margined, green to purplish, densely pubescent, 4-8 mm. long, 1.5-2 mm. wide, outer pair somewhat saccate; petals spatulate, unguiculate to gradually tapering, white to yellowish, often drying with a purplish tinge, 5-12 mm. long, 2-3 mm. wide; stamens free or the paired stamens barely united at base; siliques stipitate to nearly sessile, 6 to 10-winged, 6-8 mm. long, 5-7 mm. wide, elliptical to nearly orbicular, wings 0.5-1.5 mm. wide, sinus prominent above, ca. 1 mm. deep, absent to very slight below, stipe 0.5-1 mm. long, valves hirsute or glabrous; style thick, 1.5-3 mm. long; seeds compressed but not strongly flattened, nearly orbicular to longer than broad, 2.5-3 mm. wide, 3-3.5 mm. long; cotyledons accumbent.

Argentina: Prov. San Juan: Quebradacito Cadillo, Rio de la Tagua, *Johnston 6156* (GH); Quebrada Ortiga, eastern part of Cordillera de la Ortiga. *Johnston 6175* (GH, K, LIL); same locality, *Johnston 6176* (GH, K); Arroyo Tambillos, along trail from Paso de Valeriano, *Johnston 6087* (GH, LIL); La Colorado. Princhera de San Martin, Cordillera del Espinazito, *Kurtz 9630* (GH); Los Patillos, Cordillera del Espinazito, *Kurtz 9661* (CORD, cited type of the nomen *Hexaptera Kurtzii);* Cordillera Vacas Heladas, *Perez Moreau 30/79* (GH, isotype of the nomen var. *lasiocarpa* O. E. Schulz); entre Cienaga Redonda y Quebrada Colorado, *Bodenbender 9562* (CORD). Prov. Mendoza: between Cortaderas and Rio de las Vacas, *Cruickshanks 95* (K, type); Puenta del Inca, Las Heras, vicinity of Mount Aconcagua, *Malme 2870* (GH, S); same locality *Malme 2870a* (F, G, GH, K, S, US); same locality, *C. Spezazzini 21250* (LP); Valle de Los Relinchos, Las Heras, *J. Semper 4914* (LIL); La Cumbre Pass, *Erik Wall.* 22 Dec. 1946 (S); La Jaula, Rio Mendoza, *F. Kurtz 3471* (GH, LP, NY); Tunuyan, *Leal* 1901 (LIL); V. Horcones-Picon Grande, *Leal 191* (LP).

Chile: Without locality, *Gay 336* (F. GH, NY). PROV. ATACAMA: without further locality, *R. A. Philippi* (CORD, K); Cuesta Maricunga, *F. Philippi,* January *1885* (SGO, type of *Hexaptera tridens:* K, isotype; photo. of isotype from Berlin at F, GH); river valley below Paso de Sancarron, Dept. Vallenar, *Johnston 6211* (GH, K); vicinity of Laguna Grande, Dept. Vallenar, *Johnston 5934* (GH); vicinity of Laguna Valeriano, Dept. Vallenar, *Johnston 6057* (GH); vicinity of Laguna Chica, Dept. Vallenar, *Johnston 5980* (GH); Cord. Rio Turbio, Dept. Copiapó, *Werdermann 949* (F, G, GH, K, LIL, NY, S, UC, US). PROV. COQUIMBO: without further locality, *Cl. Gay, 1839* (F, G, GH, K, isotypes of *Hexaptera Jussiaei;* photos of type from Paris, F, GH); Baños del Toro, Dept. Elqui, *Werdermann 219* (F, G, GH, LIL, S, UC, US); same locality, *Morrison and Wagenknecht 17170* (UC); same locality, *Cabrera 3567* (LP); Quebrada Escondida, *Volckmann 1860-61* (SGO, type of *Hexaptera violacea;* GH, photo.); east of La Vega Escondida, Dept. Illapel, *Morrison 16974* (G, LIL, UC); Rodados de Lagunitas, Dept. Elqui, *Wagenknecht 18124* (G, GH, UC). PROV. ACONCAGUA: without further locality, *T. Bridges* (GH, isotype of *Decaptera trifida).* PROV. SANTIAGO: Cordilleras de Santiago, *Germain* (G); rocks above Laguna Negra, *Hastings 500* (NY, UC, US); Cepo-Jal near Santiago, *Grandjot 3689* (GH).

It is a fact that the most variable species of *Menonvillea* are among those first described. They include *M. linearis, M. Hookeri,* and *M. cuneata.* Whether this has any real significance is not apparent at present, but it is possible that exploration in Chile and Argentina, so far as *Menonvillea* is concerned, tended to take place earliest in areas where factors of the environment promote variability. *M. cuneata* is extremely variable, and the variant types have sometimes been described as separate species as the synonymy here clearly indicates. The tendency for the sepals and petals to dry purplish was used by Philippi as a basis for *Hexaptera violacea,* but there are no real characters in the type to separate it from *Menonvillea cuneata.* From field notes, it is clear that the purplish flowered specimens are not purplish when fresh, but rather of a yellowish color. The isotype and type specimen of *Hexaptera Jussiaei* and *H. tridens* respectively have more deeply lobed leaves than in the common forms of *Menonvillea cuneata,* and they are not so canescent; but I cannot find differences that support the earlier treatments of these as separate taxa. Occasionally one finds entire leaves on the lower portions of the stems, but this is rare. Kurtz No. 9661 from the Province of San Juan has mostly entire leaves; but the plants are young, and the tridentate leaves of the flowering axis are few in number only because these fertile shoots are not developed. Usually, there is a dense indument covering stems, leaves, pedicels, and sepals, but a tend-

ency toward a glabrous condition is seen in a number of specimens, especially from the province of San Juan.

There is significance in the fact that in certain plants of *M. cuneata* there are 10 wings developed upon the fruits instead of the usual 6. The added wings are less well developed than those at the lateral margins and in the dorsal position on the valves. Ten-winged plants evidently occur sporadically in populations because some plants of a given collection will have the secondary wings, and some will not. Turczaninow (l. c.) based the genus *Decaptera* on a 10-winged collection of Thomas Bridges from Chile. He spelled the locality of collection "Acoucougua", but this must be Aconcagua, where many Bridges specimens were collected. A specimen of *M. cuneata* collected by Bridges at Aconcagua is in the Gray Herbarium, but neither of the two plants has 10-winged fruits. However, a second sheet without data except "S. Am. Fielding" has two plants with 6-winged fruits and one plant with 10-winged fruits. The two plants with 6-winged fruits are similar to the known Bridges' specimens in every detail. This appears to confirm Johnston's (1928) belief that the specimens in the Gray Herbarium marked "Am. Aust. Fielding" [or "S. Am. Fielding"] are actually Bridges' specimens. In these, it is probable that I have studied two sheets of the same Bridges collection that Turczaninow used as the basis for describing *Decaptera*, but I cannot be sure of this. However, I am certain that Turczaninow's description is that of a 10-winged form of *Menonvillea cuneata*. Collections by Malme in 1903, Nos. 2870 and 2870a from "in viciniis montis Aconcagua," even though on the Argentine side of the mountain, are made up of plants mostly having 10-winged fruits. This is confirmatory evidence that plants with the 10-winged type of fruit do grow in the area where Bridges botanized at a much earlier time. The occurrence of plants with 10-winged fruits does not appear to be of sufficient weight to support segregation of them at the subspecific level, let alone at the specific or generic level.

There were three varieties of *Hexaptera cuneata* ascribed to O. E. Schulz (in litt.) and published as *nomina nuda* by Moreau (1935). I have seen only one specimen bearing Schulz's determination as a variety of *H. cuneata*, and this is a very minor variant. I think it best not to confuse the nomenclature by carrying these names even in synonymy.

6. **Menonvillea Nordenskjoeldii** (Dusén) Rollins, comb. nov.

Hexaptera Nordenskjoeldii Dusén, Svensk. Exped. Magell. **3**: 172. taf. VIII, fig. 1. 1900.

H. cuneata, var. *Nordenskjoeldii* (Dusén) Gilg & Muschler, Bot. Jahrb. **42**: 443. 1909.

H. cuneata, f. *brevifolia* Skottsberg, Kungl. Svensk. Vet. Ak. **56**: 227. 1916. Nomen.

Deep rooted perennial with fleshy branching, thick underground stems; these often prostrate and rhizome-like; aerial stems short, usually branched abruptly from the much thicker underground stems well below the ground level, terminated by tufts of leaves that tend to envelop the infructescence, 5-15 cm. long, the lower two-thirds usually buried; leaves cuneate, three-lobed, sparsely to densely pubescent, with simple long, white, twisted trichomes, 1-2 cm. long, 5-10 mm. wide. lobes obtuse to acute, up to 7 mm. long; inflorescence dense, scarcely elongating in fruit; sepals oblong, nonsaccate, densely hirsute, hyaline-margined, 3-4 mm. long, ca. 2 mm. wide; petals white, spatulate, 6-8 mm. long; pedicels hirsute, 10-12 mm. long, divaricate to ascending; siliques stipitate, 6-winged, nearly orbicular, 5-7 mm. long, 5-7 mm. wide including wings, sparsely to rather densely hirsute over the valves, wings 1.5-2 mm. wide; stipe ca. 1 mm. long; style 1.5-2 mm. long; seeds nearly oval, thick, wingless, ca. 3 mm. long, ca. 2 mm. wide; cotyledons obliquely incumbent. Southernmost Argentina and Chile.

Argentina: TERR. SANTA CRUZ: Rio Fosiles, Lago San Martín, *Dusén 5984* (S); Rio Fosiles, *Dusén 5912* (S); Cerro Solo, Lago Viedma, *Witte 12* (NY); Cerro Toro, S. Patagonia, *Borge 133* (S); Patagonia, *Tonini & Moreno 113* (NY).

Chile: TERR. AYSEN: International Highway east of Puerto Aysen, *Pirion 3458* (GH); L. S. U. Florida, *Donat 540* (G). TERR. MAGALLANES: Cord. Señoret, *Donat 433* (GH, K, LIL). Rio Tarde, Patagonia Andes, probably Chile, *Skottsberg 684* (S).

Menonvillea Nordenskjoeldii is the most southern of the species of this genus, evidently existing in a rigorous climatic area. All of the specimens bearing appropriate data show that they were collected above 3000 ft. and below 5000 ft. At the latitude of southern Chile and Argentina, such altitudes indicate high alpine or tundra conditions. Skottsberg (l.c.) and Gilg, who identified the Cruciferae of Skottsberg's southern South American collections, were apparently of the opinion that *M. Nordenskjoeldii* was only a minor variant of *M. cuneata*, and the specimens were identified with that species. I do not deny that these two species are closely related. However, there are distinctive features that characterize

M. Nordenskjoeldii, such as the very much condensed inflorescence and the long twisted trichomes. The nearly glabrous forms of this species, I feel sure, are produced by the shedding of the indument. In my opinion, *M. Nordenskjoeldii* represents a geographically isolated and sufficiently coherent group of populations to justify recognizing it as a taxon of specific rank.

7. **Menonvillea spathulata** (Gill. & Hook.) Rollins, comb. nov.

Hexaptera spathulata Gill. & Hook., Bot. Misc. **1**: 351, pl. 73. 1830.

H. pusilla R. A. Philippi, Anal. Univ. Chile **41**: 674. 1872.

H. spathulata, var. *pusilla* (Phil.) Reiche, Anal. Univ. Chile **90**: 89. 1895.

H. spathulata, subsp. *pusilla* (Phil.) Gilg & Muschler, Bot. Jahrb. **42**: 443. 1909.

H. cuneata, var. *edentata* Kuntze, Rev. Gen. **3**: pt. 2; 6. 1898.

Caespitose perennial; underground stems forming a branched caudex, woody to slightly fleshy; lower leaves tufted, numerous, petiolate, spatulate to broadly obovate, entire, obtuse to nearly acute, 5-20 mm. long, 3-8 mm. wide, densely pubescent with ascending silky trichomes to sparsely pubescent; cauline leaves few, overlapping, similar to basal leaves except narrower; flowering stems erect or decumbent, 2-5 cm. long, hirsute; pedicels hirsute, divaricately ascending to widely spreading, 5-10 mm. long; sepals hirsute, broadly oblong, hyaline-margined, semi-persistent, 3-3.5 mm. long, 1.5-2 mm. wide; petals white to lightly purpurascent, spatulate, 4-5 mm. long, ca. 2 mm. wide; siliques often purpurascent, ridged laterally over the valves, 6-winged, nearly globular, 3-4.5 mm. long, 4-5 mm. wide, sparsely pubescent with simple trichomes, stipe 0.5 mm. to nearly obsolete, wings thick, up to 1 mm. wide; style thick, 1-1.5 mm. long; seeds plump, slightly longer than broad, ca. 3 mm. long, ca. 2 mm. wide; cotyledons accumbent. Distributed at high elevations in the Andes of Mendoza, Argentina, and adjacent Chile.

Argentina: Andes between Chile and Mendoza, *Gillies* (K, type). PROV. MENDOZA: Laguna del Diamante, San Carlos, *Belegno and Palacios 4330* (GH, LIL); Portejuelo oriental de la Laguna del Diamante, *Kurtz 11111* (CORD); Rio Diamante, *Carette 25* (LP); Cajon del Burro, near San Raphael and the valley of the Rio Atvel, *Wilczek 432* (GH, US); Arroyo de La Cascada, San Carlos, *Kurtz 11067* (GH); Quebrada del Pazo de la Cruz, San Carlos, *Leal 11684* (LIL); Paso Cruz, *O. Kuntze 51* (NY, type; CORD, isotype of *Hexaptera cuneata*, var. *edentata*); C. Nevado, *Kurtz 5617* (CORD); Vegas de Llanche, *Leal 7215* (LIL); Valle del Alto, Tunuyan, Tunuyan, *Leal 1898* (LIL).

Chile: Paso Cruz, *O. Kuntze s.n.* (NY); Valle de Maipo, Cordillera de Santiago, *C. Grandjot s.n.* (S); Frente Volcan Maipo, *Carette 202* (LP); Paso de las Avestruces, between Santiago and Mendoza, *F. Leybold 105,* 1871 (SGO, type of *Hexaptera pusilla;* GH, photo); La Valdes, Valle de Colina, *Garaventa 3508* (GH).

Menonvillea spathulata is a low densely caespitose species with a deep tap root and an underground branching caudex. This taxon is more than a depauperate phase of *M. cuneata,* as might be inferred from the fact that Otto Kuntze described it as a variety of the latter species. *M. spathulata* is not only smaller in most respects than *M. cuneata,* but the smaller leaves are consistently entire rather than tridentate, and the longer white trichomes are ascending on the leaves rather than reflexed as in *M. cuneata.* There is considerable variation in *M. spathulata* in size as well as in the density of the covering of trichomes on the leaves. In some specimens (*Leal 7215*, *Kurtz 11111*, etc.), the basal leaves are silvery pubescent; in others (*Leal 2056*, *Garaventa 3508*, etc.), the trichomes are less numerous, and the leaves appear much greener. And there are intermediates forming a continuous variation series in between these extremes.

There is a marked tendency toward purplish red coloration in the fruits of *M. spathulata.* This may be in the form of a fringe along the wings or may be more general over the fruit as a whole. Lateral ridges are well developed on the valves of the siliques.

M. spathulata is a high-elevation plant. The data of the specimens I have seen show an altitudinal range from 2,500 to 3,500 meters.

The application of the name *Hexaptera spathulata* subsp. *glaberrima* Gilg and Muschler (Engl. Bot. Jahrb. 42: 443. 1909) is a mystery. The specimen upon which it was based was reported to have been collected in Mexico. I feel very sure that *Menonvillea* does not occur in Mexico, and the description is not sufficiently pointed to permit a proper interpretation of the name. I have not seen the type specimen.

8. **Menonvillea frigida** (Philippi) Rollins, comb. nov.

Hexaptera frigida R. A. Philippi, Fl. Atac. 8. 1860.

Perennial; caudex branched but free of leaf-bases; stems arising from each caudex branch, 5-8 cm. long including the infructescence, glabrous,

unbranched but tufts of young leaves in axils of the older ones show branching does sometimes occur, lower portion brownish, upper straw-colored; leaves all similar, extending from caudex branches to infructescence, rather crowded, thick and somewhat fleshy, narrowly lanceolate, entire, tapering toward apex and toward base but without a marked petiole, 1-2 cm. long, 1.5-3 mm. wide, glabrous or with a few simple trichomes at the tip or occasionally along the margin; infructescence 3-5 cm. long, rachis 1.5-2 mm. thick; pedicels crowded, divaricately ascending, arching outward from rachis, slender but markedly expanding to a receptacle 1 mm. wide, 6-8 mm. long, glabrous or with one or two simple trichomes just below the receptacle; gynophore 1 mm. long; silique glabrous, 4 mm. long, wing 1 mm. wide, with a sinus above but none below; style 1.5 mm. long, stigma not expanded; sepals sparsely covered with long simple trichomes, these 0.5-0.75 mm. long.

Chile: Rio Frio, Atacama (SGO, type; photo., GH). The citation by Philippi (l.c.) is "In valle Rio Frio dicta ad c. 24 54′ lat. mer. et 10800 p.s.m. specimena duo inveni."

The type specimen consists of a single late-season plant in which the fruits were shed. One half of a silique, one flower together with young buds, and a few attached sepals are present. The replum, of course, remains attached to the pedicel in each case. No other specimens referrable to this species have been seen so that one might suspect it of being an aberrant form of some other species. However, the one plant with its entire, somewhat fleshy and practically sessile leaves on short stems arising from separate caudex branches, has distinctive features not found in the same combination in any other species. Until further material or field study provides evidence to the contrary, *M. frigida* requires recognition.

9. **Menonvillea Comberi** Sandwith, *Kew Bull.* **1928**: 108. 1928.

Annual (because of the extensive root-system, the specimens look like perennials); stems branched from a short stout axis, hirsute, 5-10 cm. long, upper branches slender, spreading; basal leaves crowded, persistent, forming a rosette, spatulate to cuneate, dentate to lobed at apex, petiolate, 1.5-4.5 cm. long, 0.5-1.5 cm. wide, hirsute with simple trichomes; cauline leaves similar to basal, up to 2 cm. long; inflorescences terminating each branch, lower flowers bracteate; pedicels hirsute, 0.5-1.5 cm. long; sepals hirsute, ovate with a hyaline margin, 3.5-4.5 mm. long; petals spatulate, unguiculate, white, 6.5-7.5 mm. long;

stamens including anthers 3-4 mm. long; siliques sparsely hirsute, valves scutiform-orbicular, 4-5 mm. long, 4-4.5 mm. broad, wing-margined, wings 0.5 mm. wide; style thick, ca. 2 mm. long.

Known only from the type. "Annual, growing in loose sandy soil in open places. Flowers pure white, sweet-scented. Leaves soft, greenish or reddish." Sierra Mamuil, 40° S., 1650 m., December 29, 1926, *H. F. Comber 914* (K, type).

Specimens of this species are very distinctive when compared to others of *Menonvillea*. The densely crowded rosette of basal leaves, large flowers and large, sparsely hirsute fruits distinguish it immediately from its nearest relatives, *M. alyssoides* and *M. patagonica*. Nothing is known about the species other than the information given by the collector, as quoted above, and that obtainable from the original collection. Evidently the species was successfully grown from seeds collected by Comber (1928) and was, at that time, considered to be a good prospect for horticulture. Whether it has been maintained in cultivation is not known.

10. **Menonvillea alyssoides** Rollins, sp. nov.

Annual; stems several to numerous from an elongated crown, more or less equal, outer stems tending to be decumbent, 5-15 cm. long, 1-1.5 mm. in diameter, sparsely hirsute with simple white trichomes, branched in the inflorescences, the branches being very slender; leaves all similar, often reddish, petiolate and pinnately lobed, broadly spatulate to oblong, sparsely hirsute with simple acicular trichomes; lower leaves not forming a basal rosette, 2-3 cm. long, 5-10 mm. wide; cauline leaves reduced upwards, the uppermost becoming bracts for the lower flowers of the inflorescence; inflorescences terminating every branch; pedicels slender, straight, divaricate, 5-7 mm. long, sparsely hirsute with acicular trichomes up to 0.5 mm. long; sepals persistent, sparsely hirsute, non-saccate, oblong, purplish with a hyaline margin; petals spatulate to obovate, unguiculate, white to slightly purplish, 2.5-3.5 mm. long, 1.5-2 mm. wide, claw papillose at base; paired stamens erect, often persisting between the valves of the fruit, filaments dilated and papillose at base, ca. 2 mm. long, single stamens with shorter curved filaments, anthers oval, 0.5-0.75 mm. long; siliques glabrous, 4-winged, valves separated, convex on inner face, concave on outer face, ca. 2 mm. high, wings of the valves extending away from replum, often curved sufficiently to nearly complete an enclosure, wing margin uneven; replum margins thickened laterally, pressed together; septum not present; style 1-2 mm. long; seeds oval, wingless, somewhat compressed, ca. 1.5 mm. long; cotyledons accumbent.

Herba annua; caulibus erectis vel decumbentibus 5-15 cm. longis; sparse hirsutis superne ramosis; foliis petiolatis pinnati-lobatis hirsutis spathulatis vel oblongis, 2-3 cm. longis, 5-10 mm. latis; pedicellis tenuibus divaricatis sparse hirsutis 5-7 mm. longis; sepalis persistentibus non saccatis oblongis; petalis albis vel lilacinis spathulatis unguiculatis 2.5-3.5 mm. longis; siliquis glabris tetrapteris; alis reflexis, stylis 1-2 mm. longis; seminibus discoideis compressis immarginatis; cotyledonibus accumbentibus.

Type in the herbarium of the Royal Botanic Gardens, Kew. "Alyssum like." Fls. white, fragrant; common, dry sandy places, Zapala, Territory of Neuquén, Argentina. November 12, 1925, *H. F. Comber 66.*

This species is related to *M. patagonica* and to *M. Comberi.* From the latter, it differs in having glabrous instead of sparsely pubescent siliques, pinnately lobed oblong leaves instead of cuneate to spatulate terminally lobed leaves and much smaller flowers and fruits. For example, the petals of *M. Comberi* are 6.5-7.5 mm. long as compared to 2.5-3.5 mm. long in *M. alyssoides* and the fruits are at least twice as large. Perhaps of even greater significance is the difference in wing position on the fruit. In *M. alyssoides*, the wings are markedly curved and extend from the valve margins to nearly enclose the concavity at the back of the valve. The fruit of *M. Comberi*, while somewhat concave, has the wings projecting more laterally as in many other species of *Menonvillea. M. patagonica* is a much smaller plant than either of the other species, lacking the prominent branching, simple inflorescences and well-developed wings on the fruits. The valves of the fruits of *M. patagonica* and *M. Comberi* are scutiform but those of *M. alyssoides* could not be so described. All three species differ from others of *Menonvillea* in having the valves definitely convex toward the replum and concave on the opposite side. The valves of other species of *Menonvillea* are the reverse, having a convex outer side and either a flat or concave side toward the replum.

11. **Menonvillea patagonica** Speg., An. Mus. Nac. Buenos Aires VII: 229. 1902.

Annual; cotyledons persistent; stems simple or branched, 1-3 (5-10 according to Spegazzini) cm. long, hirsute with white acicular trichomes, more or less densely clothed with erect leaves; leaves all petiolate, shallowly pinnately lobed to repand, oblong

to spatulate in outline, obtuse, hirsute, 4-8 mm. long, up to 2 mm. wide; inflorescence dense, lower portion bracteate; sepals hirsute with simple trichomes, hyaline-margined, 1 mm. wide, 1.5 mm. long, outer pair slightly saccate and boat-shaped, inner flat and non-saccate; petals white, spatulate, c. 1.5 mm. long; stamens 1-1.3 mm. long, filaments dilated and minutely papillose at base, anthers ca. 0.3 mm. long, 0.3 mm. wide; pedicels straight, divaricately ascending, 3-4 mm. long, hirsute with large acicular trichomes; siliques consisting of nearly separated valves, sessile to subsessile, glabrous, inner face of valves convex, outer face concave, thickish wings turned away from the replum and accentuating the concavity of the valve surface; valves nearly orbicular in outline, 2-3 mm. high, 2-3 mm. broad, margins slightly undulate, with a marked sinus above and below; styles thickish and narrowing toward stigma, 0.5-1.0 mm. long; stigma not capitate; septum absent; replum margins contiguous; ovules reduced to one in each loculus; seeds wingless, cotyledons accumbent.

Argentina. Chubut: Sandpampe vid Rio Senquer ["im Sand am Rand einer kleinen Salzlagune zw. Arryo Apelej und Rio Senguer" cf. Skottsberg (1916)]. Nov. 21, 1908, *Skottsberg 591* **(S.)**

I have not seen the type of this species, the above description having been taken from the specimen cited. This is slightly at variance with the original description of Spegazzini, particularly with regard to size characteristics. Obviously, Spegazzini had larger more branched individuals, but in the essentials of the flowers and fruits, the plants must be very similar. The tiny plants of Skottsberg's collection are quite obviously short lived annuals and since the cotyledons are still attached, even though the plants are in fruit, it may be assumed that their life cycle is completed very rapidly. Experience with similar annuals from arid regions would lead us to expect a wide variability in the size of plants, the amount of branching dependent upon environmental circumstances. It is interesting that this species has certain characteristics in common with *M. alyssoides*, to which it is obviously related. The development of the valves in these species produces a convex form toward the replum and a concave form on the opposite side. An extension of the margins into wings tends to amplify this concavity. As indicated above this is in

sharp contrast to the usual valve shape in *Menonvillea*, in which the convex portion is on the side opposite its attachment to the replum.

12. **Menonvillea hirsuta** Rollins, sp. nov.

Perennial with a tap root; caudex thickened, unbranched; stems several, decumbent to nearly erect, densely hirsute with large white trichomes, 4-10 cm. long; basal leaves spatulate to broadly oblanceolate, thick, densely hirsute, 5-7-lobed toward apex, surface uneven, 2-3 cm. long, 4-7 mm. wide; cauline leaves reduced upward, similar to basal, lobes sometimes reduced to three; inflorescences dense, 1-3 cm. long, lowermost flowers bracteate; pedicels diverging almost at right angles to rachis, slender, densely hirsute, 3-8 mm. long; sepals persistent, densely hirsute, broadly oblong, nonsaccate, 3-3.5 mm. long, ca. 2 mm. wide, with a narrow hyaline margin; petals unguiculate, white, broadly spatulate, 5-6 mm. long, 2.5-3 mm. wide; stamens markedly unequal, free, filaments swollen at base and papillose on the swollen area; siliques with a short stipe, valves oval, pointed above, densely hirsute, 5-6 mm. long, 4-5 mm. wide, 4 lateral wings very narrow, less than 1 mm. wide, dorsal wing reduced to a rib, ventral orifice extending nearly the length of the valve; stipe less than 1 mm. long; style ca. 1 mm. long; mature seeds not seen.

Herba perennis; caudicibus crassis; caulibus decumbentibus vel erectis hirsutis 4-10 cm. longis; foliis basilaribus spathulatis vel late oblanceolatis hirsutis 5-7 lobatis 2-3 cm. longis, 4-7 mm. latis; inflorescentiis congestis 1-3 cm. longis; pedicellis tenuibus divaricatis hirsutis 3-8 mm. longis; sepalis persistentibus hirsutis late oblongis nonsaccatis 3-3.5 mm. longis, ca. 2 mm. latis; petalis albis unguiculatis late spathulatis 5-6 mm. longis, 2.5-3 mm. latis; siliquis crassis hirsutis 4-alatis 5-6 mm. longis, 4-5 mm, latis; stylis ca. 1 mm. longis; seminibus immaturis.

Type in the herbarium of Instituto Miguel Lillo, collected on Cerro Ventana, Rio Negro, Argentina, Jan. 20, 1946, *Neumeyer 664*.

The single known specimen of *Menonvillea hirsuta* consists of three plants. These indicate a species with relatively stout decumbent stems arising from the axils of the crowded leaves of the somewhat thickened caudex. The inflorescences terminating each stem or branch are dense, and the pedicels and rachis of each are covered with stiff, simple white trichomes. The fruits, except for the outermost portions of the wings, are densely hirsute. *M. hirsuta* is allied to *M. Hookeri* and its relatives, but the connection is not a close one. The densely hirsute siliques immediately

distinguish *M. hirsuta* from that group of species. A further distinguishing feature is the absence of dorsal wings. A very strong raised rib or ridge is present in the position where a dorsal wing should be and this appears to be a remnant of the wing formed from the basal portion. This ridge is covered with trichomes indicating the close relationship of it to the valve wall. The whitish lateral wings are devoid of trichomes although the basal portion of each is densely hirsute.

13. **Menonvillea longipes** Rollins, sp. nov.

Perennial herb; caudex thick, elongated, branched, straw-colored, upper portion covered with numerous old straw-colored leaf-bases; basal leaves petiolate, numerous, persistent, sparsely pubescent with simple appressed bow-shaped trichomes, pinnately lobed, apex and lobes obtuse, blade 3-6 cm. long, 2-3 cm. wide, petioles 8-15 cm. long; cauline leaves petiolate, upper nearly entire; stems several to numerous, 3-5 dm. high, branched above, striate, sparsely pubescent with simple appressed or irregularly spreading bent trichomes, stramineous below; fruiting pedicels slender, hirsute, 1-1.5 cm. long, nearly straight, divaricately ascending, expanded at summit; sepals dimorphic, one pair oblong to elliptical, flat and nonsaccate, opposite pair boat-shaped and slightly saccate, ca. 2.5 mm. long; petals white, broadly spatulate, unguiculate, papillose at base, 4-5 mm. long, ca. 1.5 mm. wide; paired stamens united toward the base; all filaments slightly dilated below and papillose, anthers ca. 0.75 mm. long; siliques glabrous, ovate in outline, stipitate, hexapterous, wings narrow and irregular, ca. 0.25 mm. wide, valves triangular, indehiscent, attached to replum by the upper two thirds, 3.5-4.5 mm. long, 2.5-3.5 mm. wide; gynophore 0.5-0.75 mm. long; replum closed, septum, if present, only at the upper end; style 1-1.5 mm. long, expanded over the valves into a prominently bilobed stigma; funiculi short, less than 0.25 mm. long, one funiculus on each side; seeds plump, oblong, wingless, ca. 2.5 mm. long, 1.75 mm. wide; cotyledons obliquely incumbent.

Herba perennis; caudicibus crassis ramosis elongatis; foliis basilaribus petiolatis persistentibus sparse pubescentibus pinnati-lobatis obtusis; caulibus 3-5 dm. altis superne ramosis striatis sparse pubescentibus; pedicellis fructiferis tenuibus hirsutis divaricato-adscendentibus 1-1.5 cm. longis; petalis late spathulatis unguiculatis 4-5 cm. longis; siliquis glabris ovatis stipitatis hexapteris 3.5-4.5 mm. longis, 2.5-3.5 mm. latis; stylis 1-1.5 mm. longis; seminibus oblongis ca. 2.5 mm. longis, 1.75 mm. latis.

Argentina: "En las cercanias de la quebrada 2 a 4 leguas mas Arrib. del Vallecito, Sierra Famatina, Prov. de la Rioja," January 21, 1879, *G. Hieronymus and G. Niederlein 609* (GH, type; G, isotype).

This species is definitely in the same alliance with *M. Hookeri* and *M. scapigera* being more closely related to them than to *M. perstylosa* and to *M. famatinensis.* However, like the latter, it is isolated in the well known Sierra Famatina where endemic species of various plant genera abound. *M. longipes* is the tallest of the species above mentioned yet its fruits are no larger than those of *M. famatinensis.* In *M. longipes*, the wings of the fruits are considerably narrower than in either *M. Hookeri* or *M. scapigera*, and the pedicels are consistently longer than in those species. In the latter two species, there is an abundant and often dense covering of straight simple trichomes. These are erect to appressed on the leaf-surfaces and usually erect on the stems, petioles, and pedicels. In *M. longipes*, the trichomes are bow-shaped, less dense, being sparse on fully expanded leaf-surfaces and most commonly appressed on stems, pedicels, and petioles, as well as on the leaf-blades themselves. Similarly, sparse bow-shaped trichomes occur on a glabrate form of *M. Hookeri* from Chile (var. *glabra* Gilg & Muschler?), but these plants have very large siliques compared to those of *M. longipes* and much shorter pedicels. Though only a single collection of two specimens has been seen, it shows the same kinds of divergences that exist between other species of the genus and appears to be distinct.

14. **Menonvillea Hookeri** Rollins, nom. nov.

Hexaptera pinnatifida Gill. & Hook., Bot. Misc. **1**: 350, t. 72. 1830, not

Menonvillea pinnatifida Barn. in C. Gay, Fl. Chile **1**: 182. 1844.

Perennial, usually with an elongated woody branched caudex; old leaf-bases persistent; stems one to several, branched, 2-6 dm. high, erect, densely pubescent with simple spreading trichomes, rarely almost glabrous, usually stramineous below; basal leaves petiolate, pinnatifid, 8-15 cm. long, densely pubescent with sharp simple trichomes, blade obovate, 2-4 cm. wide, petioles 5-10 cm. long, lobes ovate to broadly oblong or obovate; cauline leaves few, pinnatifid to dentate, lower petiolate, upper sessile, reduced and tending to be entire; inflorescence elongated, 3-10 cm. long, rather lax; pedicels divaricately ascending, sparsely to densely hirsute, 8-14 mm. long; sepals nonsaccate, hirsute,

thin, hyaline-margined, 3-4 mm. long, 1.5-2 mm. wide; petals white, spatulate, not differentiated into blade and claw, 4-5 mm. long, 1.5-2 mm. wide, sparsely papillose at base; paired stamens united, dilated, and papillose at base, ca. 5 mm. long; anthers 1-1.25 mm. long; siliques indehiscent, hexapterous or decapterous, glabrous, nearly orbicular, 7-10 mm. high, 6-9 mm. wide, wings strongly veined, 1.5-3 mm. wide, sinus well developed above, shallow or nonexistent below; gynophores 1-1.5 mm. long; styles 2-3 mm. long; seeds plump, broadly oblong, 3-3.5 mm. wide, ca. 2 mm. wide; cotyledons incumbent to obliquely so.

Argentina: PROV. MENDOZA: Alto Valle del Sosneado, *Burkart, Troncoso and Nicora* (LIL); Arroyo Grande Frente de Los Molles, *Sleumer 530* (LIL); Mendoza, July, 1837, *D. Walker-Arnott* (G); Lenas amarillas, Cordillera de Mendoza, *F. Kurtz 7143* (CORD, GH, LP, NY); Cerro del Medio, Estancia El Salto, *Leal 5482* (LIL); Arroyo Las Miangas, *Carette 199* (LP); Rio Malal-hue, Casa de Pincheira, *Kurtz 5697* (GH); Rincon de Los Arenales, *Kurtz 10977* (CORD).

Chile: Quebrada de Rios dicta alt, in valle Andinum Chilensium, *Dr. Gillies* (K, type); hills above Villavicenzio, Nov. 15, 1822, *Dr. Gillies* (K, paratype); high Cordillera, 1833; *Gray* (G, GH); Prov. Curioco?, 1841, *Bridges 1118* (K); without locality, *Cuming* (G); "prope Ladera de las Vacas in Valle Hermosa, Andinum Mer.", *Gillies* (GH, K); Valle del Yeso, *Gillies* (K); Cordillera de Santiago, 1876, *Philippi* (G); above Laguna Negra, vicinity of Santiago, *Hastings 507* (NY, UC, US); Santiago, *Bro. Claude-Joseph 816* (US); in Monte San Ramon, prov. Santiago, *C. Grandjot* (S); Lo Valdés, valle del Maipo, *Garaventa 3310 and 3311* (GH); Maipo, *Bro. Claude-Joseph* 2988 (US); Braden Mine, above Rancagua, *Mrs. E. E. Bastin 11* (US); Paso Cruz, *O. Kuntze s.n.* (NY); Baños del Flaco, San Fernando, Colchagua, *Moreau 23112* (BA, GH); El Teniente, O'Higgins, *Pennell 12284* (GH, F).

The nearest relative of *M. Hookeri* is undoubtedly *M. scapigera.* In fact, the two are not sharply delineated and might, with some propriety, be considered as infraspecific groups of the same species. However, if they were to be placed together, a rather uncommon (for the genus) amount of variation would then characterize the species. It does appear from the specimens available that a real hiatus exists between the two taxa and that two species, in fact, are represented. Further study from the point of view of cytogenetics is definitely indicated. Help from some such source is needed to establish more definitely the specific limits involved.

M. Hookeri is a well known species and was one of those used to found the genus *Hexaptera.* It is variable in growth-form, ranging from loosely growing plants 3-6 dm. high of the lower elevations to those of densely caespitose habit from elevations of 2-3000 meters. The basal leaves are ordinarily pinnately lobed,

but in some specimens (*Pennell 12284*) they are merely deeply dentate. The number of wings on the fruits is also variable. There are, in most instances, six well developed wings on each fruit, but in certain specimens (*Garaventa 3310* and *3311* from Lo Valdés in the valley of the Maipo, Chile) four secondary wings are found on the fruits in addition to the six primary ones. Other than in the number of wings on the fruits, these specimens do not differ from others of *M. Hookeri.*

15. **Menonvillea scapigera** (Phil.) Rollins, comb. nov.

Hexaptera scapigera R. A. Phil., Anal. Univ. Chile **21**: 398. 1862.

Perennial; caudex simple or branched, invested in stramineous leaf-bases, 1-2 cm. thick; stems one to several, erect, simple or infrequently branched, hirsute with simple spreading trichomes, 1.5-2.5 dm. high; basal leaves numerous, erect, with overlapping bases, oblanceolate, pinnatifid, thickish, 4-12 cm. long, 1-2 cm. wide, densely hirsute, long-petioled, lobes obtuse to rounded; cauline leaves none or few, reduced upward and dentate to nearly entire when present; inflorescence compact, 3-10 cm. long; pedicels slender, divaricate to ascending, crowded, hirsute, markedly expanded at apex, 7-14 mm. long; sepals nonsaccate, broadly oblong to obovate, hirsute, 4-5 mm. long, 2.5-3.5 mm. wide, hyaline margin narrow; petals white to creamy white, narrowly spatulate, uneven to shallowly notched at apex, 8-10 mm. long, 1.5-2.5 mm. wide, dilated and densely papillose at base; stamens 5-7 mm. long, filaments of paired stamens fused from base upward 1/2 to 1/3 of the way, paired stamens ca. 1 mm. longer than single, filaments of all stamens dilated and papillose at base, anthers 1-1.25 mm. long; siliques glabrous, stipitate, indehiscent, hexapterous, 4-6 mm. high, 3.5-5.5 mm. wide, wings well developed, smooth, sinus pronounced above and below; gynophores 1.5-2 mm. long; styles 1.5-2 mm. long; stigmas expanded over the locules; seeds plump, one in each locule, 2.5-3 mm. long, ca. 2 mm. wide; cotyledons incumbent. Plate 3, fig. 1-3.

Argentina: Prov. San Juan: La Colorada, Cordillera del Espinazito. *F. Kurtz 197* (CORD). Prov. Mendoza: Portillo (Portezuelo del Portillo), lado de Mendoza, 1861/62, *W. Diaz s.n.* (SGO, type); Paso Cruz, *O. Kuntze 50* (CORD. NY); Quebrada del Paso de La Cruz de Piedra (Aduana), San Carlos, Jan. 15, 1949. *R. Leal 11701* (GH. LIL); Laguna del Diamante, San Carlos, Jan. 27, 1950. *Bulegno & Palacios 4328* (GH. LIL); Real de La Trece, San Carlos, Jan 17, 1941. *R. Leal 7158* (LIL); Rio Salado Superior, Alverjalito, Jan. 29—31, 1892. *F. Kurtz 7156* (CORD); Valle del Alto Tunuyan, a orillas del rio en el Real Renionino. Tunuyan, Dec. 25, 1933. *R. Leal 1897* (LIL); Rincones del Cerro Morado

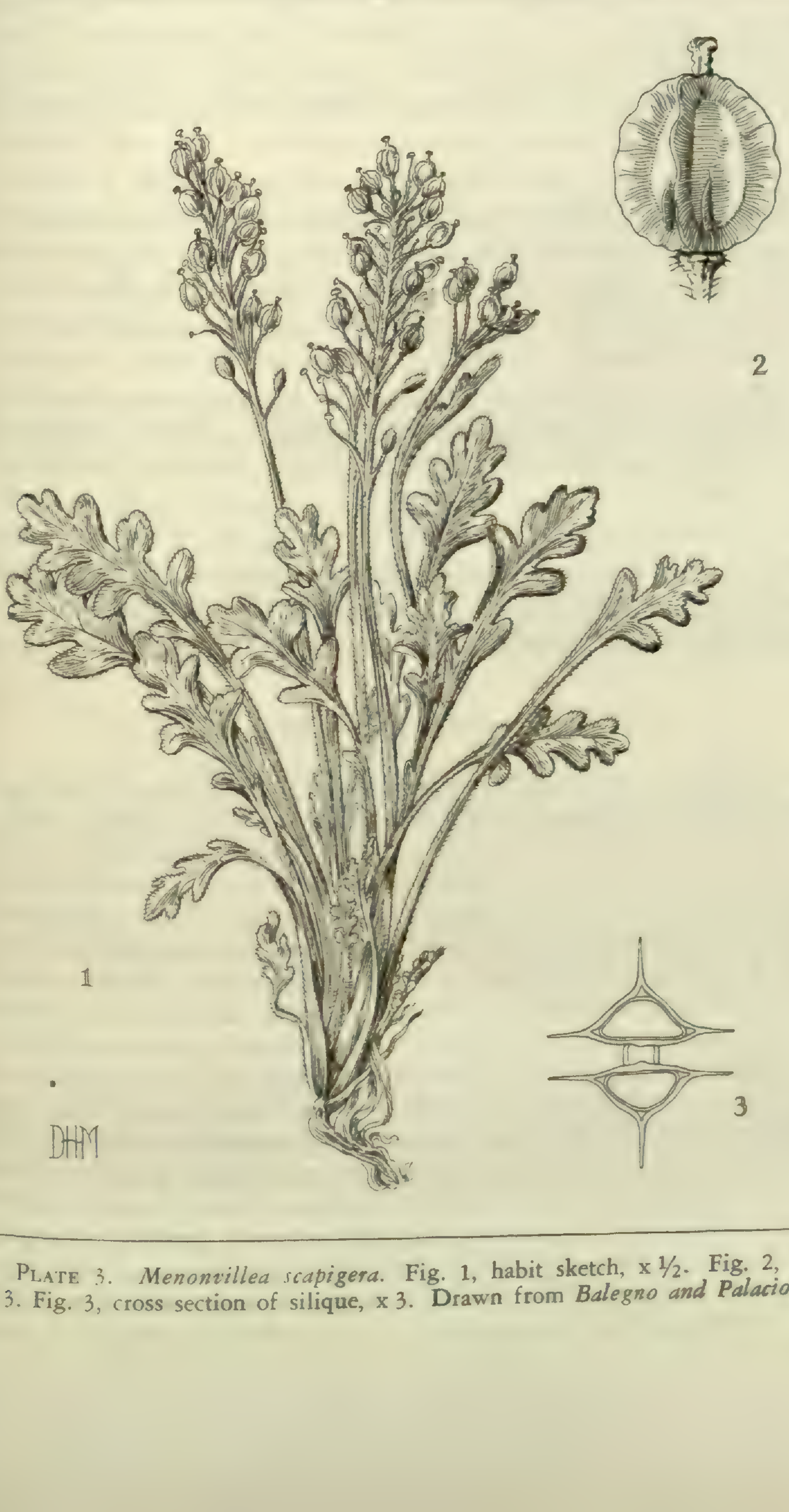

PLATE 3. *Menonvillea scapigera*. Fig. 1, habit sketch, x ½. Fig. 2, silique, x 3. Fig. 3, cross section of silique, x 3. Drawn from *Balegno and Palacios* 4328.

(Precordilleras), Tunuyan, Feb. 21, 1935, *R. Leal 3172* (LIL); Nacimiento del Arroyo Las Cuevas (Precordilleras), Tunuyan, Feb. 20—21, 1935, *R. Leal 3142* (LIL); Camino al Paso Portillo, en laderas de la Cuesta de los Afligidos, Tunuyan, Dec. 24, *R. Leal 1913* (LIL). PROV. NEUQUEN: Barda Las Lajas, 1925—26, *H. F. Comber 269* (K).

The implication of the name *scapigera* has only limited significance so far as this species is concerned. The single plant making up the type specimen upon which Philippi based the species has one flowering stem that happens to be devoid of leaves, but specimens similar to the type in other respects do have one or two cauline leaves. At the higher altitudes, the plants have reduced stems, and there is a greater tendency towards the scapose habit than is found in plants from lower elevations. Correlated with the somewhat dwarfed habit of the high altitude plants are larger flowers and less elongated caudices. These correlated characteristics represent the extreme in one direction while the larger, more highly branched, smaller flowered type, usually found at lower altitudes, carries the name *M. Hookeri.* These two species are extremely closely related, and it may be found necessary to merge them as a better opportunity to study the nature of their variability is afforded.

16. **Menonvillea perstylosa** Rollins, sp. nov.

Perennial with a ligneous, branched caudex; stems several from each caudex branch, stramineous, 1-1.5 dm. long, branched, hirsute with a dense covering of simple, spreading trichomes; basal leaves arising from the caudex which retains a covering of old leaf-bases, pinnately lobed, 5-8 cm. long, 2-3 cm. wide, hirsute on both surfaces with stiff pointed trichomes, lobes linear, remote, 1-1.5 cm. long, 2-3 mm. wide, rachis narrow, 1.5-2.5 mm. wide; pedicels slender, spreading nearly at right angles to divaricately ascending, hirsute, abruptly expanded at summit, 8-10 mm. long; sepals hirsute with simple, pointed trichomes, oblong, broadly hyaline-margined, ca. 4 mm. long, 1.5-2 mm. wide, inner pair nonsaccate, outer pair slightly saccate at base; petals white, spatulate, not differentiated into blade and claw, irregular-margined above, 4.5-5.5 mm. long, 1.5-2 mm. wide, sparsely papillose at base; paired stamens united to a point above the middle, filaments ca. 3 mm. long, filaments of single stamens ca. 2 mm. long, anthers ca. 1 mm. long, all filaments swollen and sparsely papillose at base; siliques immature, stipitate, hexapterous, glabrous, wings irregular-margined; style ca. 3 mm. long; stigma bilobed and well developed.

Herba perennis; caudicibus lignosis; caulibus ramosis hirsutis 1-1.5 dm. longis; foliis basilaribus pinnati-lobatis petiolatis hirsutis 5-8 cm. longis, 2-3 cm. latis; pedicellis tenuibus divaricatis hirsutis 8-10 mm. longis; sepalis oblongis ca. 4 mm. longis, 1.5-2 mm. latis; petalis albis spathulatis 4.5-5.5 mm. longis; siliquis immaturis stipitatis hexapteris glabris, stylis ca. 3 mm. longis.

Chile: Province of Valdivia, southern Chile, collected by E. Reid (Type in Herb. Kew).

Although this taxon is known from a single specimen, it seems to be properly ranked as a distinct species. However, without added evidence from a study of a wider representation of whatever natural populations may exist, it is impossible to be certain of this. If there were a fair probability of obtaining new material within a dozen years or so, I should be inclined to pass over such a specimen without attempting to place it within the genus. But the chances of obtaining further specimens from the area within a reasonable time do not appear promising. *M. perstylosa* is related to *M. Hookeri* from which it is distinguished by the linear instead of ovate to obovate leaf-segments and longer style. The linear leaf-segments of this species are remote from each other along the rachis of the leaf, giving a very distinctive appearance.

17. **Menonvillea famatinensis** (Boelcke) Rollins, comb. nov.

Hexapteris famatinensis Boelcke, Rev. Argent. Agron. **18**: 171. 1951.

H. pinnatifida Gill. & Hook., var. *nana* Hieron. ex Hoss. Bol. Acad. Nac. Cien. Córd. **26**: 98. 1921.

Perennial with a long, fleshy tap-root; caudex branching, upper portion invested in leaf bases; leaves tufted, numerous on each caudex branch, petioles long and slender, straw colored, blade oblanceolate, acute, dentate, leaves including petiole 3-8 cm. long, 4-10 mm. wide, densely pubescent with sharp appressed unbranched trichomes, cauline leaves absent; stems slender, weak, unbranched, 3-5 cm. long, usually exceeded by the leaves, strigose; infructescence congested, 1-2 cm. long; pedicels slender, divaricate, densely pubescent, 1-1.5 cm. long; siliques ovate, 6-winged, glabrous, stipitate, wings narrow, irregular, ca. 0.5 mm. wide, erose-margined, stipe 0.75-1 mm. long, valves oval to broadly oblong in outline, prominently veined, 3.5-4.5 mm. long, 2-3 mm. wide, attachment area extending above valve; style ca. 1 mm. long; stigma expanded; seeds oblong, ca. 1.5 mm. long, 1 mm. wide; cotyledons obliquely incumbent.

Argentina: Cueva de Perez, Sierra Famatina, Prov. de la Rioja, January 26-28, 1879, *G. Hieronymus and G. Niederlein 379* (G, K, isotypes; GH, photo.).

The siliques of *M. famatinensis* are rather similar to those of *M. longipes*, but the rest of the plant is utterly different. When considered together with *M. Hookeri* and *M. scapigera*, *M. famatinensis* is of much denser growth and possesses a larger, more enduring root system than either of them. The plants are more tufted and of much smaller stature than the three related species. The term "nana" fits the species very well. I am in complete agreement with Boelcke as to the distinctness of this species. His figure 1 (l.c. p. 173) illustrates it very well. I have not seen material of Boelcke's variety *sphaerocarpa*, but the illustrations of it indicate that it is a taxon worthy of nomenclatural recognition. To make it available in *Menonvillea*, the name is transferred below. It should be pointed out that Boelcke's name *famatinensis* has nothing to do with *Hexaptera cuneata*, var. *famatinensis* Hieron. ex Hoss., which was based upon entirely different plants. In the present work, the latter name is referred to synonymy under *M. virens* Phil.

Menonvillea famatinensis, var. **sphaerocarpa** (Boelcke) Rollins, comb. nov.

Hexaptera famatinensis, var. *sphaerocarpa* Boelcke, Rev. Argent. Agron. **18**: 175. 1951.

The type of the variety is *J. H. Hunziker 1941* from Cueva de Perez, Sierra de Famatina, La Rioja, Argentina. A second collection from the same location, *Hieronymus and Niederlein 379 1/2* is also cited by Boelcke.

18. **Menonvillea constitutionis** (F. Phil.) Rollins, comb. nov.

Hexaptera constitutionis F. Philippi, Anal. Univ. Chile **81**: 335. 1892.

Perennial; caudex branched and possessing remnants of old leaf-bases; stems several, simple or branched, 1-3 dm. long, sparsely pubescent with simple fine crinkled trichomes; basal leaves numerous, entire or with a single tooth near apex, glabrate, linear-oblanceolate to narrowly spatulate, obtuse, thickish, veins obscure, 2-6 cm. long, 2-5 mm. wide, blade narrowing gradually to a slender petiole that is expanded at base; cauline similar to basal, reduced upward; infructescence crowded, 4-8 cm. long; pedicels ascending, overlapping, deeply grooved, sparsely pubescent, 4-6 mm. long; sepals glabrate, narrowly oblong to slightly oblanceolate, hyaline-margined, markedly saccate at base, 5-6 mm. long,

1.5-2 mm. wide; petals yellowish, narrowly lingulate, thickish, tapering from near apex to base, 10-12 mm. long, ca. 2 mm. wide, sparsely papillose at base; stamens equal, free, not expanded at base but sparsely papillose, anthers narrowly oblong, ca. 1.5 mm. long; glandular tissue thin and scale-like, continuous, well-developed; siliques glabrous, 6-winged, valves keeled on inner surface, sinus present above and below, 5-6 mm. long, ca. 5 mm. wide, wing 1 mm. wide; gynophore 0.8-1 mm. long; style 1.5-2 mm. long; stigma unexpanded; seed plump, 2.5 mm. long, 2 mm. wide; cotyledons incumbent to somewhat obliquely so.

Chile: Dünen am Strande von Constitución, November, 1893, *K. Reiche* (SGO); at the mouth of the Maule River, near Constitución, *R. Azocar* (Type, SGO); Costa (Coast? Precise locality not given), Dec., 1922, *Bro. Claude-Joseph 2176* (US).

In this species are combined the floral characteristics of *M. linearis*, the generic type species, and a 6-winged fruit which is supposed to be distinctive of the genus *Hexaptera*. The dorsal wing of each valve is nearly as strongly developed as the lateral wings, and there is no suggestion of the type of callus that is present in the same position on the silique of *M. linearis*. There is a strong lateral vein-pattern in the wings and on the valve itself. Three lateral veins originate from the three main veins of the valve located at the base of each wing and at the apex of each valve angle. They are at right angles to the main veins.

The relationships of *M. constitutionis*, as indicated by most of its characteristics, are definitely with those species, which under any circumstance, would be retained in the genus *Menonvillea*. However, it does have the 6-winged fruit, which led Philippi to describe it as a species of *Hexaptera*.

19. **Menonvillea purpurea** (Hastings) Rollins, comb. nov.

Hexaptera purpurea Hastings, Bull. Torr. Bot. Club **32**: 622. 1905.

H. linearis Barn. in Gay, Fl. Chil. **1**: 176, t. 5, fig. 3, 1844; not *Menonvillea linearis* DC. Syst. **2**: 420. 1821.

Perennial; caudex woody, branched, often thick; stems several, simple or branched, 2-4 dm. high, glabrous or sparsely pubescent; basal leaves linear to linear-lanceolate, thickish, glabrous, not differentiated into petiole and blade, 4-8 cm. long, 1-3 mm. wide, entire or rarely linearly lobed near apex; cauline leaves similar to basal, reduced upward, few; inflorescence narrowly racemose, dense during anthesis, elongating in

A.

B.

C.

D.

E.

F.

G.

PLATE 4. A-D, *Menonvillea purpurea.* Fig. A, habit sketch, x ½. Fig. B, cross section of silique, x 5. Fig. C, flower, x 3.5. Fig. D, silique, x 5. Drawn from *Biese 983* and *984*. E-G, *Menonvillea alata.* Fig. E, flower, x 5 Fig. F, silique, x 5. Fig. G, habit sketch, x ½. Drawn from the type, *E. E. Gigoux* s.n., Sept., 1885.

fruit; sepals saccate, especially the outer pair, yellowish white, purple or tinged with purple, hyaline-margined, glabrous, narrowly oblong, 5-7 mm. long, ca. 1.5 mm. wide; petals linear to narrowly spatulate, erect, yellowish to brownish yellow, thick, 7-10 mm. long, 1-1.3 mm. wide; stamens free, nearly equal, ca. 6 mm. long; glands petaloid, forming a cupule at base of stamens; pedicels divaricate, short, 1-2.5 mm. long, glabrous or very sparsely pubescent with white trichomes; siliques hexapterous, glabrous or with a few scale-like trichomes, stipitate, slightly longer than broad, not flattened, 4-6 mm. long, wings ca. 1 mm. wide, valves hard, thick, dorsal wing rarely with small calluses at base on each side or usually without calluses present; gynophores < 1 mm. long; styles 1-1.5 mm. long; seeds oblong, plump; cotyledons incumbent. Plate 4, Fig. A-D.

Chile: Talcarequé, prov. Colchagua, *Gay* (F, GH, photos of type of *Hexaptera linearis*). PROV. SANTIAGO: rocks near Laguna Negra, Feb. 6, 1902, *G. T. Hastings 480* (UC, US, isotypes); Rio Yeso, Lag. Pinguene, *Biese 910* (LIL); Rio Yeso, Lag. Negra, *Biese 983* and *984* (LIL); ad lacum Lag. Negra, *Grandjot s.n.* (S); in monte Cerro Provincia, *Grandjot s.n.* (S); Maipo, *Bro. Claude-Joseph 2969* (US); Paso Cruz, *O. Kuntze s.n.* (NY).

Menonvillea purpurea is very closely related to *M. linearis* and looks very much like that species. The principal differences are found in the fruits. In *M. linearis* there are only four wings ordinarily present while in *M. purpurea* there are six wings.

The valves of *M. linearis* have a well developed caruncle or callus on the dorsal side that is conspicuous even when a very much abbreviated wing is occasionally found atop it. Usually, the dorsal wing of the fruit of *M. purpurea* has no suggestion of a callus at base, but in one specimen. (*Bro. Claude-Joseph 2969*) thickenings of small size are found at the base of the wing proper.

Menonvillea purpurea has shorter pedicels, and the smaller siliques are more nearly divaricate than in *M. linearis* where the fruits tend to be erect. The purple in the sepals and fruits of some plants of *M. purpurea* is probably of no taxonomic significance although that is perhaps implied by the specific name.

20. **Menonvillea pinnatifida** Barn. in Gay, Fl. Chil. **1**: 182. 1844.

Annual, biennial or possibly perennial; root often quite thick; stems divaricately branched, tending to be virgate, somewhat gyrate, sparsely to densely pubescent with white, highly branched trichomes, 1-4 dm. long; leaves all cauline, pectinate with 5-7 linear lobes or rarely with only three linear lobes, sparsely pubescent to densely pubescent and canescent, 2-5 cm. long, petiole and rachis narrow, lobes 1-3 cm. long,

0.5-1.5 wide; inflorescence narrow, rachis gyrate, flowers tending to alternate; pedicels divaricately ascending, slender, sparsely pubescent to nearly glabrous, 2-4 mm. long; sepals glabrous or very sparsely pubescent, broadly oblong or slightly obovate, scarious margined, 3-5 mm. long, both pairs or at least the outer pair prominently saccate; petals linear to narrowly lingulate, thickish, yellow, 6-8 mm. long, ca. 1 mm. wide; stamens free, exceeding sepals; siliques stipitate, slightly longer than broad, 3.5-5 mm. long, 3-4 mm. wide, tetrapterous, with 2 dorsal and 2 ventral wrinkled calluses, these marginal to the silique proper and at the base of the wings, pubescent with white, bulbous trichomes or nearly glabrous, wings narrow, usually less than 0.5 mm. wide, sinuses present above and below; style ca. 1 mm. long; seeds broadly oblong, 2-2.5 mm. long, ca. 1.75 mm. wide; cotyledons obliquely accumbent.

Chile: Prov. Coquimbo: Coquimbo, *Cl. Gay 332* (F, isotype); Coquimbo, *Cl. Gay* in 1839 (F = fragment from Geneva, isotype?); Los Llanos, Estero de Guanta, Dept. Elqui, *Johnston 6238* (GH); Road Rivadavia to Laguna Dam, ca. 105 km. from Rivadavia, Dept. Elqui, *Worth and Morrison 16393* (UC); Rodados Rio Seco, Dept. Elqui, *Wagenknecht 18116* (GH, UC); Rodados de Rio Seco a 4 km. mas arriba de Nueva Elqui en camino a mineral El Carmen. Dept. Elqui *Wagenknecht 4007* (GH).

Menonvillea pinnatifida is most clearly related to *M. chilensis,* but differs rather remarkably in habit. One of the first distinctive features seen is the gyrate rachis of the inflorescence and a similar tendency towards a gyrate main stem though this feature is not as marked as in *M. flexuosa.* The pectinately divided leaves with very narrow divisions are also quickly recognized as the mark of a distinct species.

21. **Menonvillea linearis** DC., Syst. 2: 420. 1821.

Annual to perennial, with a deep root and branched caudex; stems one to several, 2-6 dm. high, robust to slender, simple or branched, glabrous or with a sparse pubescence near base; basal leaves linear, entire to few-lobed, usually not differentiated into petiole and blade, glabrous to very sparingly pubescent with simple, white trichomes, flat and thickish to nearly terete, 3-8 cm. long, < 1 to 3 mm. wide; cauline leaves similar to the basal, reduced upwards, overlapping to remote; inflorescence dense, narrow and somewhat spicate; flowers fragrant; pedicels slender, ascending to divaricately ascending, glabrous to very sparingly pubescent, 3-6 mm. long; sepals narrowly oblong, yellowish, with a prominent hyaline margin, 5-7 mm. long, ca. 1.5 mm. wide, outer pair markedly saccate, inner pair less so; petals linear, yellow, thickish, slightly expanded and papillose at base, 8-12 mm. long, 1-1.5

PLATE 5. Fig. 1 - 3, *Menonvillea linearis*, var. *filifolia*. Fig. 1, habit sketch, x ½. Fig. 2, silique, x 3. Fig. 3, cross section of silique, x 3. Drawn from *Wagenknecht 18551*. Fig. 4 - 6, *Menonvillea orbiculata*. var. *orbiculata*. Fig. 4, habit sketch, x ½. Fig. 5, cross section of silique, x 3. Fig. 6, silique, x 3. Drawn from *E. E. Gigoux s.n.*, 1922.

mm. wide, widest near apex; stamens subequal, filaments papillose at base; glands petaloid, forming a cupule at base of stamens; siliques stipitate, erect, 4-winged, elliptical to nearly orbicular in outline, longer than broad, glabrous or with a few trichomes on each side of a dorsal callus and on the ventral surface (bulbous trichomes more abundant in var. *filifolia*), valves hard and thick, sloping into the marginal wings, wings entire or crenate, 1-1.5 mm. wide; occasionally reduced, sinuses subequal to deeper below, ca. 1 mm. deep, calluses tuberculate in var. *filifolia*, less well defined in var. *linearis*; gynophore up to 2 mm. long; style thick, 1.5-2 mm. long; seeds oblong, wingless, 1.5-2 mm. long, 1.2-1.5 mm. wide, radicle exceeding the cotyledons; cotyledons incumbent. Only *M. linearis*, var. *filifolia* is illustrated, cf. Plate 5, Fig. 1-3.

Wings entire; callus more or less prominent but not tuberculate; trichomes few or none on the silique; plants perennial ..... 21a. var *linearis*.

Wings crenate; callus tuberculate; bulbous trichomes abundant on the siliques; plants annual. ..... 21b. var. *filifolia*.

21a. **Menonvillea linearis** DC., var. **linearis**.

M. robustula Steud., Flora **1856**: 411. 1856.

M. trifida R. A. Phil. Linnaea **28**: 610. 1856.

M. trifida Steud., Flora **1856**: 411. 1856.

M. linearis DC., var. *trifida* (Phil.) Reiche, Anal. Univ. Chile **90**: 83. 1895.

M. virgata R. A. Phil., Linnaea **28**: 671. 1856.

M. linearis DC., var. *virgata* (Phil.) Reiche, Anal. Univ. Chile **90**: 83. 1895.

M. falcata Reiche, Anal. Univ. Chile **90**: 85. 1895.

Dispeltophorus crassifolius Lehm., Ind. Sem. Hort. Hamb. n. 2, 1836.

Type seen in Herb. Mus. Paris, collected in Chile by Dombey; photo and fragment at F; photo at GH. Illustrated in Delessert, Icones II, tab. 56.

Chile: PROV. VALPARAISO: Aconcagua, *Geo. Robinson* (K); *Sandeman 196* (K); *Gay* in *1833* (G, K); *Buchtien* in 1895 (G, GH, L, S, US); *Capt. King* [Voyage of the Beagle] (K); *Bertero 1145* (P, type, G, GH, NY, S, isotypes of *M. robusta* Steud.); *Cuming 441* (K, GH, NY); *Garaventa 2393* (GH); *Bro. Claude-Joseph 566, 1626* and *3646* (US); *Rose 19158* (US); Quintero, Aconcagua, *Werdermann 28* (F, G, GH, LIL, S, SI, UC); Cerro del Roble (Punta Iman), Limache, *Garaventa 2392* (GH); Quillota, Aconcagua, *Bertero 1140* and *1144* (G, S). PROV. COLCHAGUA: *Philippi* in 1862 (G, S); "ad Nacimiento urbem. Chile australis," 31. X. 1896, *Dusén* (S). PROV. SANTIAGO: Cordillera de la Campania, Nov., 1853, *Ph. Germain* (SGO, type of *M. trifida* Phil.); Rio Yeso, 17 km. from Romeral, *Biese 742* (LIL); Cordillera de Maule, 1855 (1857), *Ph. Germain* (F, G, GH, K, P); Quirihue, Nuble, 1862, *Volckman* (GH, K); Conception-Fomeco, *E. Barros 5612* (GH).

21b. **Menonvillea linearis** DC., var. **filifolia** (F. & M.) Rollins, comb. nov.

M. filifolia Fisch. & Mey., Ind. Sem. Hort. Petrop. **1**. 34. 1835.
M. angustifolia Presl, Bot. Bemerk. 9. 1844.

Chile: *Cuming* in 1832 (GH, perhaps an isotype of *M. angustifolia*); "ex horto bot. Petropolitano" (K, may be an isotype); *Wm. Cruickshanks* (K); Cuesta del Chusqui, Elqui, Coquimbo, *Wagenknecht 18551* (GH, UC); Quillota, Aconcagua, *Guillemin* (GH); El Salto, *A. Garaventa H. 4114* (GH); Cerro Cruz, Aconcagua, *A. Garaventa H. 440, 1675, 1676, 2021, 2725, 2742* (GH); Prov. Aconcagua, *Philippi* in 1862 (G, S); "In paucis sabulosis secus flumen Cachapual, in monte la Leona Rancagua, *M. Bertero 426, 1140* (BM, F, G, GH, L, NY, P). Two specimens in the Botanical Museum at Stockholm collected from the "Trädgårds föreningens" in 1842 may be from seed supplied from "Hort. Petrop." Plate 5, Fig. 1—3.

This species has a number of fairly distinct populations which have been recognized and named as species or varieties, usually on slender evidence. There is what appears to be a coastal ecotype, for example, that shows the expected modifications characteristic of such an environment. These plants have larger, thicker and more succulent leaves and thicker, more succulent stems than are found in the inland types. The maritime form was first designated *M. linearis β robusta* by Hooker and was later named *M. robustula* by Steudel. This form is perennial and tends to have more decumbent stems than is characteristic of plants growing away from the coastal strip. These maritime plants appear to parallel somewhat the phenotypic expression shown by Clausen, Keck and Hiesey (1948) to characterize the coastal ecotype of *Achillea* in California. I cannot see that it represents a separate taxon of any sort.

The type plants of *M. linearis* have a very heavy root and show branching caudices with old leaf-bases and give every appearance of being perennial plants. In the species as a whole, there is a continuous gradation from what appear to be strongly perennial plants through biennial to annual types. Notes with a specimen at Kew by Christopher Sandeman say, "sub-shrub about 3 ft. high." It is probable that the plants flower the first year and in favorable conditions continue their existence over a several-year period. In the hills and mountains away from the Chilean coastal waters, the plants are definitely annual and have deviated from var. *linearis* toward finer and narrower leaves and in having a crinkled, interrupted wing on the silique instead of a smooth undivided wing as in var. *linearis*. These characters appear to

justify the retention of var. *filifolia* as a valid minor taxon.

The petaloid glands of *M. linearis* vary considerably in size and shape, but they are invariably prominent. As pointed out above, certain specimens of this species (*Otto Buchtien* in 1895) came close to being hexapterous. In three specimens, the callus is equal in prominence to that of other specimens and, in addition, there is a minor wing developed on the dorsal surface and at the ends of the callus. To me, this strongly suggests that the callus is actually a modification of the dorsal silique surface, with an ontogenetic origin similar to that of the wing. Evolutionally, the wing is probably the forerunner of the callus.

Ordinarily, the leaves of this species are entire, but many plants, including some on the type sheet, have one or a few lobed leaves. In a few specimens, most of the leaves are lobed. When lobes are present, they are usually three in number. Such plants were the basis for *M. trifida* Steud. and *M. trifida* Phil., both names proposed the same year. However, neither of the proposals is acceptable for they do not represent truly distinct, natural populations. Steudel (1856) maintained there were three distinct species represented in Bertero nos. 426, 1140 and 1145. In some cases there is a mixture of var. *linearis* and var. *filifolia*, and it seems probable that specimens of the three numbers were somehow mixed. However, contrary to Steudel's idea, all specimens belong to *M. linearis* in its broadest interpretation. I have seen a large proportion of the specimens of these three numbers.

The Wagenknecht collection from Coquimbo differs somewhat from other material of var. *filifolia* but cannot be readily separated from it.

22. **Menonvillea flexuosa**[2] R. A. Philippi. Anal. Univ. Chile 41: 674. 1872.

Perennial [probably], extreme lower portion of plant unknown; stem gyrose particularly above, erect, highly branched, the branches arising at the knee of the bend, completely glabrous, tawny, 3-5 dm. high; lower

2) I have seen an isotype of *M. flexuosa*, f. *tomentosa* Gilg and Muschler. (Engler, Bot. Jahr. XLII: 441. 1909) from the Botanical Museum, Córdoba. The specimen, collected at Santiago by R. A. Philippi and sent out under the name "Menonvillea flexuosa Ph., var. tomentosa", has a flexuose stem 2.5 dm. high, is definitely tomentose, particularly on lower stem and leaves, and possesses linear entire leaves. There are a few partially expanded flowers and one young fruit on it, but I cannot be certain whether it actually belongs with

leaves not seen; cauline leaves reduced upward, deeply three parted with linear divisions to entire, glabrous (tomentose in f. *tomentosa*), thick, nearly terete, up to 8 cm. long, 1-1.5 mm. wide; infructescences terminating each branch, 4-7 cm. long, rachis flexuose; fruiting pedicels divaricately ascending, glabrous, 2.5-5 mm. long, somewhat but not markedly expanded to support receptacle; sepals glabrous, oblong with a broad scarious margin, all four saccate at base, ca. 4 mm. long, 1.5-2 mm. wide; petals narrowly spatulate, very slight wider just above the middle than at tip, straight, tawny to brownish on dried specimens, 7-8 mm. long, ca. 1.25 mm. wide, base not dilated but papillose; stamens free, nearly equal, ca. 5 mm. long including anther which is ca. 1 mm. long, surrounded by a mold of glandular tissue at point of insertion that is not at all petaloid; silique including wings very slightly wider than high, close to orbicular, 5-6.5 mm. high, 6-7.5 mm. wide, glabrous, with a strong dorsal nerve, sinus about equal above and below, wings 4, lateral only, 1.5 mm. wide; gynoecium ca. 1 mm. long; style 1.5-2 mm., stigma expanded over the carpels; seeds nearly orbicular, somewhat flattened, ca. 3 mm. long and 2.5 mm. wide; cotyledons oblique with the edge of only one of them against the radicle.

Chile: Valle del Yeso, Prov. Santiago, Jan. 1866 — collector not known — (SGO, Type; photo., GH); Cordillera de Santiago, 1876, *Philippi* (G, CN photo. & frag.; GH, photo.).

The dorsal surface of the silique shows no suggestion of tubercles or a callosity as in other species of this alliance. A single, prominent vein-nerve extends the full length of the valve on the dorsal surface in the exact position of the dorsal wing of *M. constitutionis*, but there is no evidence of a wing. This rather strong vein has no lateral veinlets or only the barest indication of them. On the other hand, prominent lateral veinlets extend from the main veins at the base of the lateral wings into the carpel walls. There is a relatively deep and narrow sinus below and an equally deep but broader sinus above on the siliques. The leaves are thick and probably somewhat fleshy when fresh. They are either linear and entire or with as many as three linear segments.

23. **Menonvillea crassa** Rollins, sp. nov.

Perennial; stems decumbent to erect, woody toward base, thickish, whitish with a closely packed floccose pubescence to nearly glabrous, 3-6 dm. long; leaves all similar, linear, entire, thick, numerous, often

M. flexuosa or is closer to *M. linearis*. Until new material is available, I am inclined to recognize *M. flexuosa* f. *tomentosa* only with reservations as to its true taxonomic position.

borne in tufts of three to five, 5-10 cm. long, 1-3 mm. wide, young leaves whitish with a dense pubescence, older leaves becoming nearly glabrous; inflorescence elongated; pedicels divaricately ascending to slightly recurved, somewhat flattened parallel to the rachis, striate to more deeply grooved, glabrous to sparsely pubescent, 4-6 mm. long; sepals oblong, saccate, hyaline-margined, glabrous, 5-7 mm. long, ca. 3 mm. wide; petals spatulate with a narrow claw, yellowish, thickish above, not expanded and not papillose at base, 1-1.3 cm. long, 2-3 mm. wide; stamens subequal, filaments of single stamens nearly surrounded at base by a thick mold of glandular tissue, those of the paired stamens merely subtended by glandular tissue; siliques nearly orbicular, keels on the inner face, flat and without a callus on the dorsal surface, glabrous except for a few white clavate trichomes on the dorsal surface, 6-7 mm. in diameter, broadly winged, with deep nearly equal sinuses above and below, wing 1-1.5 mm. wide, gynophore ca. 2 mm. long; style ca. 3 mm. long; seeds not seen.

Herba perennis; caulibus decumbentibus crassis floccosis vel glabris 3-6 dm. longis; foliis linearibus crassis floccosis vel glabris 5-10 cm. longis, 1-3 mm. latis; pedicellis divaricatis striatis glabris vel sparse pubescentibus 4-6 mm. longis; sepalis oblongis saccatis glabris 5-7 mm. longis; petalis spathulatis fulvis 1-1.3 cm. longis; siliquis suborbiculatis tetrapteris 6-7 mm. diametro; stylis ca. 3 mm. longis.

Type in the Gray Herbarium, collected at Limari, Fray Jorge, Ovalle, Coquimbo, Chile, in November, 1925, *E. Werdermann 896*. The same collection is at the following herbaria: F, LIL, SI, U, UC. Photographs at GH and F of a Poeppig collection at Vienna show that it belongs to *M. crassa*. This collection is marked merely "Chile." However, a Poeppig collection of this species at Paris is marked "Chili borealis."

The base of the fleshy leaf in this species is slightly swollen when normal, but in many cases there is a brownish swelling that appears to be aberrant and is the probable result of insect activity. These fuscous spots are sufficiently numerous and regular on many stems to appear to be swollen nodes. However, since they are not present on all stems and the tissue of these swollen spots appears to be abnormal, it is reasonable to assume they arise as a result of insect or possibly fungus attack.

The material of *M. crassa* is not so extensive as is desirable, and there are only a few mature fruits on the five specimens available. The relatively large fruit, orbicular in outline and not possessing a well developed callus, readily distinguishes the species from *M. linearis*. The stamens and petals are not dilated and papillose at base, as in *M. linearis*, and the glands do not become petaloid as

in the latter species. *M. crassa* is definitely woody at the base and the stems are most frequently decumbent. The plants clearly show characteristics associated with a maritime habitat.

24. **Menonvillea orbiculata** R. A. Phil., Fl. Atac. 9. 1860.

Biennial or perennial with a heavy root; lower stem usually suffruticose; stems branched beginning just above the base, gyrate, whitish tomentose, becoming nearly glabrous with age, 1-2.5 dm. high; leaves terete, fleshy and thick, pectinately lobed to entire, floccose-tomentose, tufts of white trichomes persisting especially in the axils, 1-5 cm. long, 1-2 mm. in diameter, lobes linear; infructescence elongated and narrow, 5-10 cm. long; pedicels stout, spreading at right angles to slightly ascending, pubescent, 2-3 mm. long; sepals nonsaccate, pubescent, often becoming glabrous with age, oblong, ca. 3 mm. long, ca. 2 mm. wide, with a very wide hyaline margin; petals yellowish, linear, thickish, 5-6 mm. long, < 1 mm. wide, widest point just above the middle; stamens free, nearly equal, 3.5-4 mm. long; anthers ca. 1 mm. long; petaloid glands triangular if present, or absent; siliques orbicular to oval in outline, stipitate, (3-) 4-5 mm. long, (2.5-) 3.5-4.5 mm. wide, wing 0.5-1 mm. wide, sinuses above and below about equally developed, calluses 2 in the lateral position on the dorsal surface of each valve, both outer and inner surfaces with large white clavate trichomes; stipes ca. 1 mm. long; styles 1.5-2 mm. long; stigmas unexpanded; seeds broadly oblong, ca. 2 mm. long, 1.5 mm. wide; cotyledons incumbent. Plate 5, Fig. 4-6.

Siliques nearly orbicular, 4.5—5 mm. long 4—4.5 mm. wide; glands petaloid ..... 24a. var. *orbiculata*.

Siliques oval to nearly oblong in outline, 3—4 mm. long, 2.5—3.5 mm. wide; glands not petaloid ..... 24b. var. *perplexa*.

24a. **Menonvillea orbiculata** Ph., var. **orbiculata**.

Chile: Caldera, Dept. Copiapó, Prov. Atacama, *Philippi s.n.* (Type, SGO); same location, in sand in shelter of large rocks, leaf-segments terete, fleshy, and usually more or les terete, petals brownish yellow or more or less greenish yellow, Nov. 22, 1925, *I. M. Johnston 5048* (GH, K); same location, Oct., 1924, *E. Werdermann 391* (F, G, GH, K, LIL, NY, S, SI, U, UC); same location, 1922, *E. E. Gigoux s.n.* (GH); desert of Atacama, 1888—1890, *Thomas Morong 1310* (NY, US).

24b. **Menonvillea orbiculata**, var. **perplexa** Rollins, var. nov.

Herba lignosa; sepalis purpureis vel viridibus; siliquis oblongis vel ellipticis.

Siliques more elongate and less of an orbicular shape than in var. *orbiculata*, 3-4 mm. long, 2.5-3.5 mm. wide; glands not petaloid.

Chile: Cerro Yumbes, vicinity of Paposo, ca. lat. 25° 00′ S., Dept. Taltal, Prov. Antofagasta, Dec. 8, 1925, *Ivan M. Johnston 5552* (GH, type); along trail to old Paranas Mine, El Rincon, just north of Paposo, Dept. Taltal, Prov. Antofagasta, Dec. 7, 1925, *Johnston 5515* (GH, K, S).

Short, stout pedicels, gyrate, somewhat floccose, stems and a ligneous to sub-ligneous base are combined in *M. orbiculata* to make it a distinctive species. The leaves are fleshy and terete to subterete and most frequently floccose. The matted, white trichomes making up the principal component of the indument are easily rubbed off and old, much used specimens often show a reduced amount of pubescence. This is equally true of old stalks of plants growing in exposed situations. The type specimen of *M. orbiculata* is somewhat fragmentary and does not show mature fruits nor highly divided leaves. However, the material can be readily matched by other collections such as that of Gigoux, cited above, from Caldera.

M. orbiculata is most closely related to *M. chilensis* and it is possible that these species hybridize. There is some variation in the width of the wings, but this feature is not so marked as in *M. chilensis*.

There is a possibility that *M. falcata* Reiche belongs here, but the characters given by him seem to point more definitely to *M. linearis*. Unfortunately, a type was not designated nor, in fact, were any specimens cited. I find it next to impossible to tell just what Reiche had when proposing the name, *M. falcata*.

25. **Menonvillea chilensis** (Turcz.) Jackson, Index Kewensis 2: 207. 1894.

Annual; single stem highly branched beginning just above ground, branching often virgate or nearly so, branches straight to slightly gyrate in exceptional specimens, glabrous to somewhat floccose in leaf axils, 1-4 dm. long; leaves all cauline, pectinate below to nearly entire above, divisions linear, flattened, usually glabrous or sparsely pubescent, occasionally whitish from an arachnoid or floccose indument, 1-6 cm. long, segments 0.5-1.5 mm. wide; infructescence elongated, narrow, 1-1.5 dm. long, ca. 1 cm. wide; pedicels divaricately ascending to recurved, 1.5-4 mm. long, glabrous to sparsely pubescent; sepals non-saccate, hyaline-margined, glabrous or rarely sparsely pubescent, 2-2.5 mm. long, 1-1.5 mm. wide; petals linear, greenish yellow to yellowish, somewhat translucent below, thickish above, 3.5-4.5 mm. long, 0.75-1.25 mm. wide; paired and single stamens sub-equal, 2.5-3 mm. long, fila-

ments not expanded at base; siliques with narrow lateral wings on each valve or wingless, strongly ridged on ventral side of valves along line of attachment, ribbed at the center of the dorsal surface or the single rib less prominent, glabrous except for numerous bulb-like or scale-like trichomes toward the center of both dorsal and ventral surfaces of each valve, each valve with lateral prominent and wrinkled callosities, wing if present varying up to 0.5 mm. wide, sinuses above and below about equal, siliques elliptical to slightly more elongate, 2-3.5 mm. long, 1.5-3 mm. wide, stipitate; stipe 0.5-1 mm. long; styles 1-1.5 mm. long, glands well developed, subtending all stamens and producing a petaloid collar; replum thick, linear; seeds single in each loculus, somewhat flattened, wingless, 1.5-1.75 mm. long, 1.25-1.5 mm. wide; cotyledons incumbent.

Pedicels divaricately ascending to slightly recurved; siliques < 3 mm. long, with well developed wings; single rib on the back of the valve not prominent. ..... 25a. *M. chilensis* var. *chilensis.*

Pedicels recurved; siliques wingless or nearly so. < 3 mm. long; single rib on the back of the valve prominent ... 25b. *M. chilensis*, var. *aptera.*

25a. **Menonvillea chilensis**, var. **chilensis**.

Cymatoptera chilensis Turcz., Bull. Soc. Nat. Mosc. **27**: 309. 1854.

Menonvillea parviflora R. A. Phil., Fl. Atac. 8. 1860.

M. media Turcz., Bull. Soc. Nat. Mosc. **36**: 551. 1863.

M. parvula R. A. Phil., Anal. Univ. Chile **81**: 336. 1892.

M. orbiculata, var. *parviflora* Reiche, Anal. Univ. Chile **90**: 85. 1895. Based on *M. parviflora* Phil.

Chile: Prov. Atacama, Dept. Huasco, Huasco, Oct., 1866, *F. Philippi s.n.* (SGO, type of *M. parvula):* Prov. Antofagasta, Dept. Taltal—vicinity of Aguada de Miguel Diaz, ca. lat. 24° 35′ S., Dec. 1—4, 1925, *Johnston* 5313 (GH); vicinity of Aguada de Cardon, ca. lat. 24° 45′ S., Nov. 30, 1925, *Johnston 1275* (GH, S); region about Aguada Cachina, ca. 6 km. inland from Caleta Esmeralda, ca. lat. 25° 53′ S., Dec. 14—15, 1925, *Johnston 5697* (GH, K, S). Antofagasta-Atacama boundary — vicinity of Aguada Grande ["chachinal de la costa" of Philippi], ca. 26° 2′ S., Dec. 16—18, 1925, *Johnston 5773* (GH, K, S); Cachinal, *Philippi s.n.* (SGO, type of *M. parviflora:* photo, at GH). Prov. Coquimbo [3], March, 1842, *Thomas Bridges 1279* (BM, K, P, isotypes); Coquimbo, July-August, 1856, *W. H. Hervey* (S).

3) The locality is given as "Conception" in the specimen at Kew, but Johnston (1928) has shown that this was a blunder in connection with the labeling of Bridges' specimens. The place of collection in the Province of Coquimbo is not known to me. The British Museum specimen is marked "Coquimbo."

25b. **Menonvillea chilensis**, var. **aptera** (Phil.) Rollins, comb. nov.

Menonvillea aptera R. A. Phil., Fl. Atac: 9. 1860.

M. parviflora, var. *aptera* (Phil.) Johnston, Contrib. Gray Herb. **85**: 44. 1929.

Chile: Prov. Antofagasta, Hueso Pasado [northeast of Taltal, Dept. Taltal], *R. A. Philippi* (SGO, type); vicinity of Taltal, Taltal, Dec. 13, 1925, *Johnston 5640* (F. GH, K, S); Taltal, Nov., 1925, *E. Werdermann 835* (F, G, GH, K, LIL. NY, S, SI, U, UC, US); Quebrada to north of a point 42 km. out of Taltal on Chanaral road, Taltal, Oct. 15, 1938, *Worth and Morrison 16137* (G, UC); Coquimbo, Serena, *R. A. Philippi* (CORD, K).

The two lateral callosities existing as ridges toward the margins of the silique proper are conspicuous features of the fruit of this species. These bony ridges are deeply wrinkled in var. *aptera*. There is considerable variation in the width of the wings when they are present on the fruits. In a few specimens of var. *aptera*, no wing-margin can be found, but in general, even in var. *aptera*, there is a narrow band of thin issue on each side of each valve. Four wings are present on the developed ovary. A prominent rib along the middle of the dorsal surface of each valve is a marked feature of var. *aptera* while such a rib is present but much reduced in prominence in var. *chilensis*. On each side of this rib, there are numerous bulb-like trichomes which appear scale-like when dry.

The nomenclature of *M. chilensis* has the seeds of some confusion in it for the combination was first made, so far as I am aware, in Index Kewensis where, however, it was attributed to Turczaninow. At the citation given in Index Kewensis, Turczaninow renamed *Cymatoptera chilensis* as *Menonvillea media* but did not transfer the name *chilensis* to *Menonvillea*. I do not believe that an index is the proper place to make a new combination unless the intent of the author is clearly indicated. In this case, one has no way of knowing whether the combination was an inadvertence or was intentional. This is especially the case since in Volume one of Index Kewensis *Cymatoptera chilensis*, the basionym, is referred to *Menonvillea linearis*. There is no question but that the specific name *chilensis* is the proper one to use. The question pertains only to the actual transfer of the name to *Menonvillea*.

The type of *M. parviflora* has been carefully compared with an isotype of *M. chilensis*; and although there are minor differences, these fall within the expected intraspecific variation of a single species. Unfortunately, the type of *M. parviflora* is made up of somewhat fragmentary flowering material. Young fruits show, unmistakably, the initial development of lateral calluses, and certain areas of each valve are covered with bulb-like trichomes. I am satisfied that this material is properly referable to *M. chilensis*. Extreme forms of var. *aptera* appear to be quite distinct from var. *chilensis*, particularly those with the wing practically absent. However, there is a gradation from wingless or nearly wingless plants to those with substantial wings to be found within a single collection. The wingless condition apparently represents a trend of divergence that has not become fixed and certainly cannot be used as the primary basis for maintaining var. *aptera* as a distinct species.

26. **Menonvillea alata** Rollins, sp. nov.

Annual; highly branched beginning just above the ground level; stems glabrous to sparsely pubescent with white trichomes, particularly at branch axes and at leaf-bases, 1-1.5 dm. high; leaves all cauline, divided into 3-5 linear segments or entire, and linear, 1.5-4 cm. long, ca. 1 mm. wide, nearly glabrous to sparsely pubescent with crooked white trichomes; infructescences 4-5 cm. long, racemes dense; pedicels slender, spreading at right angles to slightly recurved, glabrous to very sparsely pubescent, 2-3 mm. long; sepals nonsaccate, oblong to nearly obovate, glabrous, with a wide hyaline margin, thickened in the central portion, 2-2.5 mm. long, 1-1.3 mm. wide; petals linear, thick and yellowish above, petaloid and somewhat hyaline below, widest below middle, 3-4 mm. long, 1 mm. wide; stamens subequal, slightly exceeding sepals; siliques 4-winged, orbicular, ca. 4 mm. in diameter, glabrous or with elliptical bulb-like trichomes on the dorsal and ventral surfaces, central dorsal nerve definite but not raised, valves prominently keeled on the ventral side, calluses not present, wings even, slightly turned inward, ca. 1 mm. wide, sinuses deep, equal above and below; gynophore ca. 0.5 mm. long; glandular tissue petaloid, subtending all stamens; styles 1-1.3 mm. long; seeds immature, wingless. Plate 4, Fig. E-G.

Herba annua, caulibus ramosis divaricatis glabris vel sparse pubescentibus 1-1.5 dm. altis; foliis caulinis linearibus integris vel 3-lobatis 1.5-4 cm. longis, ca. 1 mm. latis, glabris vel sparse pubescentibus; infructescentiis densis 4-5 cm. longis; pedicellis tenuibus glabris vel sparse

pubescentibus; sepalis nonsaccatis oblongis vel obovatis glabris 2-2.5 mm. longis; petalis stramineis linearibus crassis 3-4 mm. longis; siliquis tetrapteris orbicularibus ca. 4 mm. diametro stipitatis; stylis 1-1.3 mm. longis; seminibus immaturis immarginatis.

Type in the Gray Herbarium, collected in Quebrada de Chanchoquin, Copiapó, Dept. Copiapó, Prov. Atacama, Chile, Sept., 1885, *Enrique Ernesto Gigoux s.n.*

The silique shape in *M. alata* is very similar to that of *M. litoralis*, but the petals are exceedingly different, and it appears on other grounds that *M. alata* is actually most closely related to *M. orbiculata* and to *M. chilensis*. From the latter species, it differs in having no calluses on the siliques and in having orbicular siliques with a broad wing instead of elongated siliques with narrower wings.

Fully half or, in some instances, more than half of the total length of each branch is occupied by the inflorescence in *M. alata*. The plants are quite compact with numerous leaves at short intervals on the stems and with numerous flowers making up a compact raceme.

27. **Menonvillea minima** Rollins, sp. nov.

Annual; single stem highly branched beginning just above the ground level, glabrous, 3-6 cm. high, with irregular narrow wing-like ridges; branches spreading; leaves all definitely cauline, no basal rosette developed, linear, 3-lobed to entire, 1-2 cm. long, 1-2 mm. wide, glabrous, lobes linear; inflorescence crowded, elongating in fruit and occupying a major portion of the stemlength; pedicels divaricate, spreading at 45° to 60° angles from rachis, straight or nearly so, wing-margined with very narrow and irregular flaps of tissue, 5-8 mm. long, glabrous, gradually expanded toward summit; rachis deeply grooved and ridged; sepals persisting well beyond anthesis, oblong, glabrous, hyaline-margined, with a linear callus on back near the middle, nonsaccate, ca. 3 mm. long and 2 mm. wide; petals whitish, sulphur-yellow upon boiling, obovate, not markedly differentiated into blade and claw, gradually expanding in width from point of attachment to apex, ca. 5 mm. long and 3 mm. wide at widest point; stamens nearly equal, the single stamens scarcely shorter than the paired, ca. 2.5 mm. long, anthers ca. 0.25 mm. long; siliques wingless, glabrous, very tough and thick-walled, callused along margins, nearly hemispherical, ca. 1.5 mm. high and 1.5 mm. broad, unevenly wrinkled and callused on rounded outer surface; style ca. 1 mm. long, stigma unexpanded; gynophore

0.5 mm. or less; seeds very plump, filling cavity, ca. 1 mm. long, 0.75 mm. broad and 0.5 mm. thick; cotyledons incumbent.

Herba annua; caulibus ramosis glabris 3-6 cm. altis; foliis linearibus glabris, 3-lobatis vel integris 1-2 cm. longis, 1-2 mm. latis; inflorescentiis racemosis densis; pedicellis divaricatis rectis glabris 5-8 mm. longis; sepalis persistentibus oblongis glabris nonsaccatis ca. 3 mm. longis, 2 mm. latis; petalis albis obovatis ca. 5 mm. longis, 3 mm. latis; siliquis stipitatis exalatis glabris cartilagineis ca. 1.5 mm. altis, ca. 1.5 mm. latis; stylis ca. 1 mm. longis; seminibus ca. 1 mm. longis, ca. 0.75 mm. latis, ca. 0.5 mm. crassis; cotyledonibus incumbentibus.

Chile: Huasco, Dept. Huasco, Prov. Atacama, Sept., 1885, *F. Philippi 1948* (Type, SGO, photo. GH; photos of an isotype from Geneva at F, GH); Hueso Parado, Dept. Taltal, Antofagasta, *R. A. Philippi s.n.* (SGO).

Plants of *M. minima* are only a few centimeters high and are practically all inflorescence. Each branch bears a dense raceme of flowers which elongates considerably by the time ripe fruits are set. The most distinctive feature of the plant is its small, wingless, hemispherical fruits. Each valve, being indehiscent, is shed independently and has every appearance of a nutlet. The walls of the fruits are remarkably thick compared to their over all size. The outer surface is much grooved and wrinkled.

The type of *M. minima* consists of four plants mounted on the same sheet as the type of *M. parvula*, the latter consisting of two plants labeled "Thinophila parvula Ph., Huasco. Octobri 1866." One plant of *M. minima* is mounted on the same sheet as the type of *M. aptera*. Of the two plants on this sheet, it is clear that Philippi's description could apply only to the taller plant with erect branches, on the right hand side, for he wrote, "ramis erectis, strictis" and "planta 6-8-pollicaris." The specimen, which I take to be the type of *M. aptera*, is slightly over six inches high; whereas, the other plant on the sheet is about three inches high with widely spreading branches. The latter is so similar in all respects, including the stage of development, to the specimens of *Philippi 1948*, that one is tempted to suggest that this is a misplaced specimen of that collection.

28. **Menonvillea Gayi** R. A. Phil., Linnaea **28**: 610. 1856.

Annual; stems single from the root but highly branched, 8-15 cm. high, sparsely pubescent with simple, tortuous, white trichomes, pu-

bescence often denser in the axils of upper leaves and in the inflorescence; leaves linear, terete, simple to deeply 3-lobed, 2-4 cm. long, ca. 1 mm. broad, glabrous to sparsely pubescent, lobes linear and terete, basal and cauline leaves similar; inflorescence dense, 1-3 cm. long; pedicels divaricate, spreading at 45° angles to nearly right angles from the rachis, sparsely pubescent, striate, 4-8 mm. long; sepals nonsaccate, glabrous, broadly oblong, ca. 2 mm. long, ca. 1.5 mm. wide; petals white, obovate, ca. 3 mm. long, ca. 2 mm. wide, strongly differentiated into blade and claw; glands 4, petaloid, oblong to narrowly triangular, ca. 0.5 mm. long, adjacent to the single stamens; filaments 1.75-2.25 mm. long; anthers 0.5-0.75 mm. long; siliques stipitate, nearly orbicular, 4-winged on the lateral margins of the valves, keeled on the inner surface, with a large hemispherical to elongated callus on the outer face of each valve, glabrous except for a scattered ring of large flattened scale-like or wart-like trichomes adjacent to the callus and a sparse to dense covering on the inner face of the valves, wings of silique 0.5-0.8 mm. wide, sinuses equal above and below, callus 1-1.3 mm. long, ca. 1 mm. wide, siliques including wings 3-3.5 mm. long, ca. 3 mm. wide; gynophore ca. 1 mm. long; style ca. 1 mm. long; stigma unexpanded; seeds immature, only slightly flattened, ca. 1.25 mm. long, ca. 1 mm. wide; cotyledons incumbent.

Chile: Las Animas, Chañaral, Prov. Atacama (Jan., 1854, cf. Johnston 1929, p. 7) *R. A. Philippi s.n.* (Type, SGO); Argueros, Prov. Coquimbo, 1836, *Gay 1036* (SGO; photo. GH); La Serena, Oct., 1927, *Bro. Claude-Joseph 5181* (US); Coquimbo, Prov. Coquimbo, Oct. 27, 1934, *G. Montero 1838* (GH).

The relatively large callus, somewhat in the shape of a human brain, located in a central dorsal position on each valve, is distinctive of *M. Gayi,* especially when this characteristic is considered together with the obovate petals. The callus is definitely constricted around the area of attachment to the valve.

The shape and form of the callus is similar in some respects to the entire valve of the fruits of *M. minima.* These annual species of *Menonvillea* must be quick growing, for they are small plants which branch repeatedly beginning just above the ground surface and appear to have very little or no lignified tissue.

The trichomes on the fruits are relatively large when compared to the usual type of trichome of stems and leaves. When dry, they are flat and scale-like, but when moist, they are mound-like to nearly clavate in appearance. Trichomes of this type are not common in the Cruciferae.

29. **Menonvillea litoralis** (Barnéoud) Rollins, comb. nov.

Hexaptera litoralis Barn. in Gay, Fl. Chilena **1**: 177. 1846.
Menonvillea arachnoidea O. E. Schulz, Notizbl. **10**: 466. 1928.

Annual; stem single from base, branched, sparsely arachnoid pubescent to nearly glabrous, 1-2 dm. high; branches erect to only slightly divergent; leaves and leaf-divisions linear, entire or with 1-3 terminal lobes, 2-10 cm. long, 0.5-1.5 mm. wide; sparsely pubescent with white, cobwebby trichomes to glabrous; inflorescences terminating each branch, up to 8 cm. long; pedicels divaricately spreading at a 45-60° angle from rachis, nearly straight, striate, sparsely pubescent to glabrous, usually arachnoid pubescent in the axils, 6-10 mm. long; sepals oblong, nonsaccate, scarious-margined, yellowish, glabrous, ca. 1.5 mm. long; petals white to slightly yellowish, obovate, 2.5-3 mm. long, blade nearly orbicular, claw very short; petaloid glands 4, oblong, blunt; anthers ca. 0.5 mm. long, oval in outline; siliques stipitate, orbicular to slightly longer than broad, 3-3.5 mm. long, ca. 3 mm. wide; single callus dorsal not constricted below, with a raised area of surrounding valve tissue, oblong, ca. 1 mm. long, siliques with a strong almost wing-like nerve above and below each callus, broad, flat (wart-like when swollen), whitish trichomes forming an indefinite ring around the callus, similar trichomes present on inner face; valves keeled on inner side; lateral wings well developed, smooth, not crinkled, just under 1 mm. wide, sinuses above and below about equal, slightly less than 1 mm. deep; gynophore ca. 1 mm. long; style 1-2 mm. long, stigma unexpanded; seeds slightly longer than broad, wingless, plump, ca. 1.5 mm. long; cotyledons thick, incumbent.

Chile: Prov. Coquimbo: — Coquimbo, 1839, *Gay 63* (P, type; photos F, GH); Coquimbo, July-August, 1856, *W. H. Harvey s.n.* (GH, K, S); Frai Jorge, Dept. Ovalle, Aug. 13, 1917, *C. & I. Skottsberg 731* (F, NY, S); Frai Jorge, Sept. 9, 1893, *F. Philippi?* (SGO, on same sheet with the type of *M. Gayi):* Frai [as Gray] Jorgee, Nov., 1925, *E. Werdermann 1525* (photo of type of *M. arachnoidea* from Berlin at F, GH).

The very close relationship of this species to *M. Gayi* is evident, but there is a pattern of characteristics that appear to be distinctive. The callus on the outer surface of the valves is not as highly developed as in *M. Gayi*, and there is a ring of raised tissue adjacent to the callus which is lacking in the latter. A rather prominent rib extends above and below the callus in *M. litoralis*, and this was interpreted as an additional wing on each valve by Barnéoud who described it as a species of *Hexaptera*. The tendency of species of *Menonvillea* to produce both wings and calluses as thin or massive areas of tissue external to the valve runs

through the entire genus and forms a part of the basis for including *Hexaptera* within *Menonvillea.* Schulz's *M. arachnoidea* is quite obviously the same as *M. litoralis.*

Names of Doubtful Application

Hexaptera pinnatifida var. *angustata* Barn. ex Reiche, Anal. Univ. Chile 90: 87. 1895. Type not seen. I am unable to associate the varietal name with any of the specimens studied.

Hexaptera pinnatifida var. *glabra* Gilg and Muschler, Engl. Bot. Jahrb. 42: 442. 1909. This name was probably applied to the more or less glabrate plants of *Menonvillea Hookeri,* but I cannot be sure since I have not seen the type. If this is the proper application of the name, var. *glabra* should be listed as a synonym of *M. Hookeri,* for there is no real entity involved.

Hexaptera spathulata subsp. *glaberrima* Gilg and Muschler, Engl. Bot. Jahrb. 42: 443. 1909. Type not seen. This name was based on a specimen questionably cited as having been collected in Mexico. I feel quite certain that *Menonvillea* does not occur in Mexico. At least, I have seen no authentic material for that country. What Gilg and Muschler actually had I have been unable to determine from the description alone.

Menonvillea parvifolia F. Phil., Cat. Pl. Vasc. Chil. 16. 1881 [Reprinted from Anal. Univ. Chil., 1881]. This is an inadvertent misspelling of *parviflora.*

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THE FERNS OF LIBERIA

By Winifred J. Harley

The ferns form a distinctive feature of the flora of any tropical country, yet they are sometimes neglected or taken only incidentally by collectors, and they are frequently omitted from studies of a regional flora. There has been no complete study of the Pteridophyta of West Africa[1], for the Flora of West Tropical Africa (Hutchinson and Dalziel, 1927-36) did not include the ferns. This lack is shortly to be remedied in the new edition now in preparation, for which Mr. Alston of the British Museum is writing the section on pteridophytes.

For Liberia, the records of collections of ferns are particularly infrequent and scattered. In his list of African ferns, Kuhn (1868) mentions two from Liberia. Sir Harry Johnston's two-volume work included an appendix on the Liberian flora written by Otto Stapf, then on the staff of the Herbarium at Kew (Stapf, 1906). In this, he listed all the species he knew from Liberia. It includes a bare half-dozen ferns. Later, Max Dinklage prepared a list of known Liberian plants, which was published after his death by Mildbraed (Dinklage, 1937). This list included 45 species of ferns and fern-allies.

This present study attempts to bring together all known collections of ferns from Liberia. It shows the number of species and varieties increased to 118.

These plants vary greatly in size and appearance, from the tree-ferns with rigid trunks 25 feet tall, to the delicate filmy-ferns, whose fronds are only a few millimeters in diameter and a single layer of cells in thickness. They grow under a wide variety of conditions, from salt-shore to mountain-top, and from the stone-walls along the streets of Monrovia to the upper branches of giant trees in the primeval forests.

Physical Features of Liberia

The Republic of Liberia lies on the West Coast of Africa between the parallels of 4° 30′ - 8° 30′ N., and 7° 30′ - 11° 30′ W.

1) Since this was written, there has become available a study of the ferns of French tropical Africa by Mme. Tardieu-Blot (1953), well-illustrated and most useful.

Its coast-line runs approximately northwest to southeast, and is about 350 miles long. At its widest point, the country is about 175 miles across, from coast to interior border. Liberia is bordered on the northwest by Sierra Leone, and on the southeast by the Ivory Coast. The entire length of Liberia's irregular northeastern boundary divides it from French Guinea. Sierra Leone and those parts of the French colonies adjacent to Liberia exhibit many of its climatic and geographical features.

Lying within eight degrees of the equator, and having within its borders no elevation of more than 4500 feet, Liberia has an entirely tropical climate. The annual rainfall varies from about 175 inches on the coast to half that amount at points along the interior border. The rainy season extends from April to October, but there is no month in the year that may not have some rain. The harmattan winds usually blow dry across the land for a week or two in January or February causing sudden and marked evaporation of moisture,

The small size of Liberia and the absence of great variation in its climate result in a considerable degree of uniformity in the vegetation. Nevertheless, it is possible and convenient to call attention to certain features of the country which have some influence upon the plant-life there.

A traveller crossing the country from the coast to the interior border, either by car or on foot [2], notes certain changes in the country through which he passes. He crosses, first, the coastal plain, then travels through the hilly country, and sees, if he does not climb, some mountains. These zones have been rather roughly indicated on the accompanying sketch-map (Fig. 1).

The coastal plain is bordered by the maritime shores, lagoons, and tidal swamps. Behind these, for 10 miles, more or less, the plain is partly open land, with some settlements and a small amount of cultivation. Tangled thickets are common. There are many small clumps of trees, and some patches of high forest. In some places, there are sandy savannah-lands extending back into the plain from the lagoons.

2) Outside the system of private roads on the Firestone Plantations, there are not more than 300 miles of motor-road in Liberia, and most of this only very recently opened. Rivers are not usable for interior travel. Facilities for air-travel are very limited. The country is covered by a network of foot-trails, on which one may walk or be carried by hammock.

Beyond the coastal plain begins the hilly country which constitutes the greater part of the area of Liberia. Rolling hills alternate with broad swampy valleys. The coastward portion of the hilly country has an elevation, for the most part, of 100-300 feet. Roughly 50 miles back from the coast, there are rugged slopes, over which foot-trails and motor-roads must climb rather steeply. The Bomi Hills, northwest of Monrovia, where iron has recently been mined, are a part of this series of hills, as are the Bong Mountains in the region of Reputa, over which the principal motor-highway runs from Monrovia to the French border. There is also a group of mountains in Grand Bassa County. Inland, beyond these mountains, the hill-country continues. Now the hills are steeper, the streams swifter, and the swamps narrower. Much of the soil is pebbly laterite. Throughout most of the country from here to the border, the elevation varies from 600-1000 feet, but it is far from being a uniform belt, and presents a good range of topographical features. The swamps and small streams drain into a series of larger streams, which flow into the 8 or 10 sizable rivers that cross the country in a generally southwest direction. The larger of these rivers rise in French territory and cross the whole width of Liberia in their course to the sea.

Rugged mountainous areas are found in various parts of the interior, in no place rising as high as 5000 feet. The most mountainous portion of the country is the northwestern. All the way from the Bomi Hills area, which is within 30 miles of the coast, back to the French border, there are rough elevations, the highest of which are the Walo Mountains south of Vonjama. In the eastern part of the country, there are mountains of less height; and in the north-central area are the foothills and peaks of the Nimba mass, whose highest point (about 5700 feet) lies just outside Liberia near the boundary between French Guinea and the Ivory Coast.

Single rocky hills, rising abruptly from the surrounding level, are found in some places. "Rock outcrops . . . are especially to be observed north of Tchien, between Tappita and Pallila, in the Sanoquelle area, and in the Zorzor-Bolahun-Vonjama region" (Baldwin, 1952). Mayer says, "A conspicuous feature of the extreme northern parts of the Western and Central Provinces is the isolated, smoothly rounded balds, supporting a sparse herbaceous and grassy vegetation, and often exhibiting extensive bare

rocky faces" (Mayer, 1951). The hill at Gban and that at Sopia are among the rock outcrops noted by Baldwin as "in the Sanoquelle area."

To summarize, one may say that the greater portion of Liberia is an uneven expanse of hills, broken by swampy valleys. It is bordered along the coast by a narrow plain. It is roughly divided by a series of steep hills into a portion 100-300 feet in elevation, and a more interior section from 500-1000 feet high; and it is broken up here and there, especially in the more northern part, by low mountains.

Political Divisions and Towns

For purposes of administration, Liberia is divided into five coastal Counties and nine interior Districts grouped into three Provinces. The Counties are (from northwest to southeast) Cape Mount, Montserrado, Grand Bassa, Sinoe, and Maryland. The Districts are referred to in this paper by the identifying name of the headquarters-town of each. They are Boporo, Kolahun, and Vonjama Districts (Western Province), Salala, Gbanga, Sanoquelle, and Tappita Districts (Central Province), and Tchien and Webo Districts (Eastern Province). The map (fig. 1) shows these headquarters-towns, the approximate boundaries of Counties and Districts, and very nearly all of the towns referred to in the list of collections.[3]

Collectors

A large proportion of the collections recorded in the following list were made by three individuals: Cook, Baldwin, and the author. All others who have collected ferns in Liberia have been included, as far as could be ascertained.

3) It must be noted that the spellings of town-names vary according to the person who records them, as well as the informant from whom he receives them. There are a number of variations between the spellings on the map and those of collectors' localities cited. Usually, collectors' original spellings have been retained in the list. In making use of the map, it may be useful to understand that in many cases the suffix is a syllable indicating "town" or "people" in that dialect. In Gbanga and Salala Districts, for instance, the suffix is *-t.t:* in the northwest, *-bun;* in the Boporo area, *-kweli:* and in the north-central region, *-ple*. Therefore, such a name as Bakratown in a collector's list may appear on the map as Bakrata.

O. F. Cook (1867-1949) visited Liberia in the interests of the New York Colonization Society [4] and collected there between 1891 and 1895. His stations are principally Muhlenberg, Suey (Suen), and Mt. Coffee, settlements about 25 miles up the St. Paul River. A few of his ferns were collected on a trip to Boporo, 50 miles to the north. His ferns were deposited in the herbarium of the National Arboretum in Washington, D. C. Cook was accompanied during part of his stay in Liberia by a young man named F. J. Straub, and a few specimens bear Straub's name as collector. He is said to have died in Liberia. From Cook's specimens, Copeland (1933) described one new species, *Trichomanes liberiense*, and another, *T. batrachoglossum*, which proved to have been already described by Afzelius as *T. guineense*. Aside from this, Cook's ferns have not been much studied until the present time, and they were not cited by Dinklage (1937).

J. T. Baldwin collected his numbers while making a botanical and agricultural survey of the country for the United States Economic Mission in 1947-48. He covered the various sections of the country rather widely, travelling for the most part afoot. His collections, therefore, represent a much more nearly nation-wide sampling than those of other collectors. Baldwin's ferns are deposited at the Gray Herbarium, with duplicates at Kew, and a few at the British Museum. He made additional collections during a second visit to West Africa in 1949, under the auspices of the Division of Plant Exploration and Introduction, U. S. Department of Agriculture. Baldwin's ferns were made available for this study by permission of the Division of African Affairs, U. S. Department of State.

My own collections, begun in 1939 and still continuing, have been made chiefly at two stations. These two localities I have been able to cover more completely around the calendar than is possible for a transient visitor. My station designated as Ganta, in the Sanoquelle District, includes the environs of the market-town and cross-roads of Ganta, and Ganta Mission. It is located

4) Several such Colonization Societies were organized in the United States in the early 19th century for the purpose of transferring freed slaves from this country to Africa. The original settlements of these repatriated negroes along the Liberian coast were the result of the activities of these Societies. They continued their interest and aid after the several settlements united and declared themselves an independent nation.

in a thickly-settled and well-farmed area, in which residual patches and fringes of forest still persist. The other station, called Bilimu (Bili Mountain), is a steep headland at the southwest end of the Nimba mass, also in the Sanoquelle District. In this area, I have had access to a considerable expanse of primary forest. There are some numbers from other localities visited, principally in Sanoquelle District. My first set of specimens is at the Gray Herbarium, with duplicates of many at Kew and the British Museum, and a few in the United States National Herbarium.

These three collections, together with the others which have been placed in herbaria over the last 250 years, furnish the basis for this listing of the Liberian pteridophytes.

Up to the middle of the 19th century, the only ferns known to have been collected from this part of the West African coast were those occasional specimens picked up during the voyages of sailing vessels along the coast. It appears that the ships' surgeons were the scientifically-minded members of the crews, and from time to time they brought back samples of the tropical flora to botanists at home. After that, expeditions and individual travellers made more contributions to herbaria.

I am indebted to Mr. A. H. G. Alston for the following note (in litt.). Subsequently, I had the opportunity to see for myself the plants in the Sloane Herbarium.

"The earliest mention of plants from Liberia appears to be in Petiver's Musei Petiveriana, p. 46 (1699). There, Petiver refers to a collection made by Richard Planer, Surgeon, in the following words, 'This ingenious and hearty friend made me formerly some Collections of Plants, ... at Mount Serrado [the cape on which the town of Monrovia is built] on the coast of Africa: and on a Voyage since he got me other Collections from these Parts.' The specimens are still in existence in vol. '154 and 155' of the Sloane Herbarium at the British Museum (Nat. Hist.). His plants include *Selaginella myosurus*, which is the '*Muscus denticulatus major volubilis* è Capite Montes Serado' Petiver Mus. No. 534; *Dryopteris protensa* (Afz.) C. Chr.: *Lygodium microphyllum* (Cav.) R. Br.; *Asplenium africanum* Desv. (f. 15); *Polypodium lycopodioides* L. (*Filix scandens Numulariaefolio* Petiver No. 217).

"George Wingfield (fl. 1698) is another collector represented in vol. 154, f. 15. His plants include *Pteris Burtoni* Bak. It is the

'*Filix Dactyloides perelegans* è Monte Serado' of Mus. Petiver No. 215 (1698). Petiver adds, 'Found there by my ingenious Friend Mr. George Wingfield, Surgeon'; and *Lygodium microphyllum* (Cav.) R. Br.

"The same collection contained plants from Watt and Skeen: of these Petiver (Mus. p. 95 (1703)) says 'Mr. James Skeen, Surgeon, was pleased to present me with three or four Books of Plants ....he and Mr. Watt, Surgeon, deceased, had observed .... on the coast of Guinea'. Watt and Skeen had *Selaginella myosurus* (Sw.) Alston from Cape Mezurado."

The Niger Expedition of 1841-42, whose primary purpose is stated to have been to bring about the cessation of the slave trade, also aimed at increasing the scientific knowledge of Africa. They touched at some points in Liberia on their way down the coast. Mr. Ansell, an Englishman, accompanied the expedition as assistant to Theodore Vogel, the chief botanist. In those days, West Africa was rightly earning its reputation as the "White Man's Grave"; quinine had not come into use, and scientist and missionary alike fell prey to malaria. Mr. Ansell suffered severely, as did many others on this expedition. Vogel himself died before the expedition returned. Ansell and McWilliam, surgeon on one of the boats, left a few collections of ferns from Grand Bassa and Cape Palmas, points where they put in for wood and water. These numbers are at Kew and the British Museum.

In the next decade, a German botanist, Philip Schoenlein (1855), made some collections in the Cape Palmas area. He survived the climate only a few months, and the greater part of his herbarium-specimens was lost in transport. Those that were saved were deposited in Berlin and are included in Dinklage's list.

O. H. Massey was an American-born, naturalized, Liberian citizen, who taught the natural sciences in one of the schools in Monrovia in the late 1800's. By this time the coastal settlements were well-populated by the colonists from the United States. About 15 numbers of Massey's, collected in 1890, were presented to the New York Botanical Garden Herbarium by Leander Chamberlain, and in the same herbarium there is one number of a Dr. Skinner.

There is one specimen at Kew collected by someone named Carder in 1877. Henry Millen, Curator of the Botanic Gardens of Nigeria, was in Liberia in 1892, and a few of his ferns are at

Kew and at the British Museum. At the Gray Herbarium, there are two sheets from Thomas Moore's herbarium, purporting to have come from Liberia in 1897 and 1899, on which no collector is named.

Sir Harry Johnston visited Liberia in 1903, and some plants at Kew bear his name. Others, presented to Kew by Johnston, were collected by David Sim, a forester in the employ of the Liberian Rubber Corporation. In the interests of this same British company, Alexander Whyte, head of the Botanic Gardens at Entebbe, Uganda, visited Liberia and collected some plants, as H. Reynolds did also. These collectors were in Liberia in 1904-05; their ferns are at Kew, with a few also at the British Museum.

Max Dinklage lived in Liberia from 1894 to his death in 1934, as representative of a German trading firm and of the Imperial German Government. He began his collections and his study of the Liberian flora before the turn of the century, and continued until cut short by a fatal attack of dysentery, while on his way to the Nimba mountain area, on a botanical expedition sponsored by the Arnold Arboretum. His name has been given to several species and at least one genus of flowering plants. He collected near the coast, in the Grand Bassa, Cape Palmas, and Monrovia areas. His specimens were deposited at Berlin, and duplicates of some are at Kew, the Gray Herbarium, and other institutions.

R. H. Bunting, of the Department of Agriculture of the Gold Coast, collected a few plants in Liberia in 1910-12. He visited the Mt. Barclay area, where the British rubber plantation was located, and made a trip to the Gola Forest. His plants are at the British Museum.

David Linder, with the Harvard African Expedition of 1926, collected for the Arnold Arboretum. About 25 of his ferns were identified at Kew together with the other specimens he had taken, and a similar number were identified at the Gray Herbarium this year. In the same expedition was Joseph C. Bequaert, who returned to Liberia in 1943-44 and made certain collections, including a few ferns, now at Kew.

In 1928-29, G. Proctor Cooper visited Liberia for the Yale School of Forestry. The few non-woody plants which he collected were only incidental to this study of the timber-trees. He collected near the coast and in the area of the Firestone Plantation,

where extensive felling operations were going on at that time. Determinations were made at Kew, and his ferns are there.

Dora Earthy spent three or four months in the northwestern part of Liberia in 1932, while engaged in a research-project in sociology. She made some collections of plants and sent them to the British Museum. One of the fern-species she took has not been collected from any other part of the country.

W. T. Winne, of Union College, Schenectady, N. Y., collected in Liberia during two trips. During the summer of 1949, he worked mostly in the vicinity of Sanoquelle. In 1951, he returned and travelled to Tappita and Tchien, making further collections. His specimens are in his personal herbarium, with duplicates at Washington.

The Danish "Atlantide" Expedition, bound for the South Atlantic, in 1945, called at the port of Marshall. Three members of the expedition, F. C. Frazer, J. Knudsen, and K. Kraemmer, sent plants (including three or four ferns) to the British Museum. (See Atlantide Report No. 1, Danish Science Press, Copenhagen, 1950).

A. H. T. Barker, of New Zealand, in Liberia with the UNESCO mission, has collected botanical material and two of his ferns are at the British Museum.

SUMMARY OF PTERIDOPHYTE-COLLECTIONS IN LIBERIA

COLLECTOR	DATES	AREA	DEPOSITED	NUMBERS
Planer, Richard	1675	Monrovia (Montserrado)	B. M.	1
Wingfield, George	1698	"	B. M.	2
Skeen, James	1703	"	B. M.	1
Vogel, Theodore	1841—42			3
Ansell	"	Grand Bassa	B. M., Kew	5
McWilliam	"	Cape Palmas		2
Schoenlein, Philip	1855	Cape Palmas	Berlin	1
Carder	1877	?	Kew	1
Cook, O. F.	1890—95	St. Paul R., Boporo	Wash., Gray	175
Straub, F. J.	1890	"		4
Massey, Oscar H.	1890	Monrovia	N. Y.	16
Skinner	ca. 1890	"	N. Y.	1
Millen, Henry	1892—96		Kew, B. M.	2
Dinklage, Max	1898—1930	Monrovia, Cape Palmas, etc.	Berlin	45

Whyte, Alexander	1903—04	Kakata, Sino R.	Kew	5
Sim, David	1904	Sino	Kew, B. M.	3
Reynolds, H.	1905	St. Paul R.	Kew	1
Johnston, Sir Harry	1903—07	Monrovia	Kew	2
Bunting, R. H.	1910—12	Mt. Barclay, Gola Forest	B. M.	12
Linder, David	1926	Monrovia, Gbanga & Boporo Dists.	Kew, Gray	63
Cooper, G. Proctor	1928—29	Firestone Plantation	Kew, B. M., Gray	5
Earthy, Dora	1933	Bolahun	B. M.	9
Bequaert, Joseph C.	1943—44	interior	Kew	4
Harley, Winifred J.	1939—54	Sanoquelle Dist.	Gray, B. M.	212
Frazer, F. C.	1945	Marshall	B. M.	2
Knudsen, J.	1945	"	B. M.	2
Kraemmer, K.	1945	"	B. M.	1
Baldwin, J. T.	1947—49	general	Gray, Kew, B. M.	225
Winne, William	1949—51	Monrovia, Tchien, Sanoquelle	Wash.	65
Barker, A. H. T.	1952	Bili	B. M.	2

Distribution of Fern-Species

Certain geographical features of the country have been noted and presented by means of a sketch-map. Combinations of geographical and climatic factors offer a variety of conditions for the growth of the various fern-species. Some species are rather generally distributed over the country, from coast to mountains. *Nephrolepis biserrata*, *Selaginella Myosurus*, and *Lygodium microphyllum* are perhaps the commonest of all. Others which are widespread are *Microsorium Scolopendria*, *Pteridium aquilinum*, *Asplenium africanum*, and *Dryopteris protensa*. Other species are more restricted to a certain type of habitat.

Acrostichum aureum is confined to the salt-shores, and is the only fern characteristic of that zone. Winne (1952) noted *Microsorium punctatum* and *Pteridium aquilinum* also on the sandy shore. In the damp, sandy, savannah-type meadows which occur in some places along the coastal plain, *Lycopodium carolinianum* is abundant and *Selaginella subcordata* occurs. *Arthropteris orientalis* is rather common on stone-walls in Monrovia, but it is not entirely confined to the coast. Along the roadsides, *Gleichenia*

Sketch map, based on map drawn by G. W. Harley for the Institute of Geographical Exploration, Harvard University, 1938; simplified for this paper, and modified by reference to other available maps, chiefly, those of Linder (1930), and Mayer (1951).

linearis seems more common near the coast than farther inland.

The wide zone shown on the map between the coastal plain and the mountains rises from 100 feet near the coast to an average of 1000 feet near its border and includes areas of higher elevation. But no distinction in the fern-flora can be made on the basis of elevation alone. Of more importance, throughout this large portion of the country, is the persistence, or loss, of the primary forest, and the differing degrees of shade and moisture in valleys and on hilltops. In general, one may say that in this largest portion of the country, there are three principal types of habitat: swamps, clearings, and forests. Beyond, or surrounded by the middle zone, there are also the mountain-areas.

Swamps and Clearings

The swamps and choked courses of small streams between the slopes are commonly inhabited by several species of shrubs, members of the *Cyperaceae*, aroids, etc. Conspicuously clothing the thickets are the climbing ferns, *Selaginella Myosurus, Lygodium microphyllum*, and *L. Smithianum. Ceratopteris cornuta* roots in the mud when flood-waters subside. *Lycopodium cernuum* grows among the weeds. Along the grassy borders of the swamps, there are often rank growths of such ferns as *Nephrolepis biserrata, Dryopteris striata, Pteris atrovirens, Lonchitis Currori, Microlepia speluncae*, and *Marattia fraxinea.*

Sunny clearings, roadsides, overgrown townsites, and old farm-clearings provide homes for some of the more "weedy" ferns, such as *Pteridium aquilinum, Pteris linearis, Histiopteris incisa*, etc. *Pityrogramma calomelanos*, also, likes sunny open places, and many of the forest-species will grow in the clearings, but with decreased vigor.

Forest

The native practice of clearing the land for rice-farms, which are periodically moved to a new location, has caused much of the old forest to be destroyed and replaced with tracts of secondary growth. But all through the interior, there are still some stands of primeval forest, where the great trees have never been felled, either because of rough, rocky terrain, or because the density of population has not yet required the use of all the land for farms.

Occasionally, such areas of "bush" persist because they have been protected by the local tribe as sacred groves. The Gola Forest in the Western Province and the forests of the Cess River valley in the east are uninhabited areas of considerable extent, estimated by Mayer (1951) as approximately two million and four million acres, respectively (see map). In the Central Province, there are no forests of any such size, but everywhere there are to be found patches of "bush", large or small, where conditions have been little changed by man. Remnants of the original forest still fringe the rivers and smaller streams. Since the amount of sunlight, and the amount of moisture in any given spot, varies according to many different factors, no particular distinction can be made between the fern-flora of the primary forest and that of the secondary forest. Some species are capable of adapting themselves to a variety of conditions; others are usually found only in undisturbed original forest.

Species of the Forest-Floor

Among the terrestrial species found in the forest, one of the most common, and most frequently collected, is *Dryopteris protensa*. Another is *Selaginella versicolor*. *Bolbitis acrostichoides*, *B. gemmifera*, *Tectaria fernandensis*, and *Selaginella Vogelii* are not uncommon. In the damper parts of the forest are *Pteris Burtoni*, *Lonchitis Currori*, *Trichomanes guineense*, and *Selaginella cathedrifolia*. Certain species prefer the very edge of the shaded streams, where they are frequently inundated in the rainy season. This group includes *Adiantum Vogelii*, *Diplazium Sammattii*, *Dryopteris Jenseniae*, *D. Bucholzii*, and *Lomariopsis palustris*.

Epiphytes

Many species of Liberian ferns are epiphytic in habitat. The collector of pteridophytes must search the tree-trunks and upper branches (of fallen trees), as well as the foot-path. *Platycerium stemaria*, *P. angolense*, *Microsorium punctatum*, *Asplenium africanum*, *Drynaria Laurentii*, and *Lycopodium Phlegmaria* are all so large that they are conspicuous even when roosting high on the giant forest-trees. Smaller epiphytes, which prefer the higher branches of the tall trees, may be much more easily missed, such

as *Trichomanes crispiforme*, *Xiphopteris serrulata*, *Ctenopteris villosissima*, and *Ctenopteris punctata*. The species which yet remain to be collected from Liberia are probably among these high-growing epiphytes of the deep forest.

Much more accessible to the collector are the epiphytes which grow on mossy tree-trunks nearer the ground, or on old stumps, or loops of woody lianas, particularly *Loxogramme lanceolata*, several species of *Asplenium*, and the small species of *Trichomanes*. One fern that roots in the ground and climbs by a caudex adhering tightly to the trunk of a sapling or tree in the forest is *Lomariopsis guineensis*.

The numerous oil-palms (*Eleais guineensis*) which grow both in the forest and in the clearings, support a large epiphytic flora. When forest is cut for a rice-farm, the oil-palms are spared for their economic value, and they are generally able to survive the farm-burning. Thus, in clearings and second growth, the palms are conspicuous. As the older fronds die and drop off or are lopped off by men gathering palm-nuts, the persistent woody bases remain adherent to the trunk, clothing its length with horny stubs, sharply angled upward so that they catch a quantity of detritus and decaying matter. In the fertile soil of this mass, there are many epiphytes growing, not only ferns, but also orchids, species of *Piper*, *Peperomia*, *Ficus*, *Coleus*, *Mussaenda*, and others. This mass of frond-bases, debris, and epiphytes, which clings to the trunk of the oil-palm, eventually becomes too rotten and heavy to support its own weight, and there comes a time when it parts from the living trunk and slides to the ground leaving the palm-trunk naked.

Fern-species which frequent the trunks of the oil-palms include *Nephrolepis biserrata*, *N. undulata*, *Vittaria guineensis*, *Microsorium Scolopendria*, *Oleandra africana*, *Davallia chaerophylloides*, and *Microgramma lycopodioides*.

Cola-trees (*Cola nitida*), being of rather slow growth, and being protected by the native people even more carefully than the oil-palms, are also common hosts for epiphytic ferns. *Platycerium stemaria* is frequently found on a cola-tree at the edge of a village, or beside a path. *Loxogramme lanceolata*, *Arthropteris orientalis*, and *Antrophyum immersum* seem to favor the cola-tree as host.

Species of the Hills and Mountains

The typical rock-outcrops, mentioned earlier, constitute a habitat favored by certain grasses and associated plants. Among the ferns that may be found on such outcrops, as well as on exposed rocky ledges in the higher mountains, or even on large boulders among the hills are the following: *Selaginella leoneensis, S. Kalbreyeri, Adiantum philippense, Asplenium formosum,* and *Nephrolepis undulata.*

Of the mountainous areas, the one with which I am most familiar is the elevation called Bilimu, some 3300 feet above sea-level, and about 12 miles east of Sanoquelle. Bilimu rises abruptly 1200 feet above the country to the west and south of it. It is, actually, the southwestern end of the Nimba mass, of which the highest peak lies outside of Liberia. Bilimu is a roughly U-shaped ridge with the right arm of the U running northeast directly toward Nimba, the left arm running off into broken hills to the north. The highest point along the ridge is at the curve of the U, and it is from this point that the mountain drops off most sharply toward the south and west, the face being so steep and rough as to make it unscalable for all ordinary purposes, and the vegetation scanty. A vacation-lodge is situated on the highest point of Bilimu ridge, and several weeks spent there at various times have given me the opportunity to collect plants on the slopes of this mountain.

At the top of Bilimu, the atmosphere seems constantly near the saturation-point. Fog and mist are common, and plants that need moisture can thrive here the year around. At this elevation, the forest-undergrowth is less dense than on the lower level of the surrounding country, but many of the same species of trees and plants are to be found. The formation of the ridge is shaly ledge, uptilted in the southwestern direction, but, except for the steep face, the rock is covered with sufficient soil to support a stand of large trees, *Lophira alata*, *Parinarium*, and others. There are very few palms. Several large trees at the top were cut when the point was used as a triangulation-point by the Boundary Survey, about 1930. *Harungana madagascariensis* and other secondary forest-species have sprung up, and an epiphytic species of *Utricularia* grows on their trunks in the rainy season. All over the ridge, the forest-trees and woody vines are covered with dripping

moss. Associated with the mosses, some of the smaller species of *Trichomanes* may be found. *Asplenium Barteri, A. hemitomum, A. Geppii,* and *A. Dregeanum* are plentiful. *A. megalura* inhabits the higher branches and, like *Lycopodium Phlegmaria,* is seldom seen except as broken pieces on the ground beneath the big trees.

In the inner angle of the U, the ridge falls off somewhat less steeply. About 100 feet from the highest point, a small stream arises. Fed by many small springs and by condensation and seepage, it increases in size and makes its way down the valley for a mile or more before turning to the south and emerging through a gap in the ridge which separates Bilimu from the next peak to the east. A quarter of a mile down from its source, a valley broadens out, almost completely hemmed in by steep forested slopes which is a miniature paradise for the collector. This valley is the home of a grove of graceful tree-ferns (*Cyathea Manniana*). Underneath the open canopy of *Cyathea*, the rank vegetation includes *Lonchitis Currori, Marattia fraxinea,* and *Diplazium proliferum,* all of which grow far taller than a man. In the rocky bed of the stream, *Dryopteris securidiformis, Asplenium variabile,* and *A. paucijugum* grow in abundance. There are several species of *Bolbitis,* including *B. fluviatilis,* which cling to rocks that are covered at every freshet. On favorable ledges and wet rocks near the stream are *Anisosorus occidentalis, Trichomanes cupressoides, T. erosum, Pteris Burtoni,* and many other ferns, along with begonias, aroids, a species of *Elatostema,* and other moisture-loving herbs. *Arthropteris monocarpa* twines on shrubs in the ravine.

As one follows the stream down through the narrow valley, below this point, the large species of tree-fern (*Cyathea Manniana*) is soon left behind, but most of the other species just enumerated may still be found. A smaller tree-fern with coarser fronds (*Cyathea camerooniana*) occurs here and in other stream-beds in the vicinity. *Antrophyum Mannii* grows here, well up on the trunks of medium-sized trees overlooking the stream, and *Lomariopsis Rossii* climbs larger trees. Along the wooded slopes are *Tectaria fernandensis, Bolbitis auriculata, Dryopteris Currori* and *D. protensa, Pteris pteridioides,* and *Diplazium sulcinervium.* Most of the forest-dwelling species previously mentioned are also to be found here.

Special Adaptations to Environment

Many of the tropical species show a response to their damp environment by various types of vegetative reproduction. Ferns whose fronds take root and produce young plants at their tips include *Asplenium paucijugum*, *A. Barteri*, *Bolbitis acrostichoides*, *Selaginella Kalbreyeri*, *S. Vogelii*, and *Trichomanes cupressoides*. Other species, such as *Bolbitis gemmifera*, *B. salicina*, *Pteris Burtoni*, *P. spinulifera*, and *Dryopteris Currori*, commonly produce buds at the base of the terminal segment. There are some ferns that develop their gemmae at still other points. At the base of certain segments, *Diplazium proliferum* develops large buds that form new plants on the rachis. *Tectaria fernandensis* forms buds (usually several) situated on the midrib, on the upper, or lower, or on each surface of the terminal segment of the frond, or of one of the lateral pinnae. *Asplenium emarginatum* regularly produces buds in a V-shaped notch at the apex of the midribs of the several pinnae. *Dryopteris Jenseniae* may form large buds near the axil on the lowermost lobule on the acroscopic side of a pinna or pinnule. These buds appear to form in special sori occurring in this position. They develop into remarkably vigorous plantlets which, while still attached, often have a rhizome approximately as large as that of the mother-plant. *Asplenium Dregeanum* multiplies by sending out modified stolon-like fronds which take root and produce a colony of daughter-plants.

Another interesting adaption is illustrated by two of the Liberian genera, *Platycerium* and *Drynaria*. Both these ferns have at the base of the fertile fronds, specialized sterile fronds, whose function is the retention of a mass of humus and moisture at the roots of these large epiphytes.

Distribution of Species

There are a very few species of ferns in Liberia that are more or less cosmopolitan: *Pteridium aquilinum*, *Osmunda regalis*, and *Lycopodium carolinianum*.

Species which are found in most tropical countries include *Dryopteris dentata*, *Histiopteris incisa*, *Psilotum nudum*, *Nephrolepis biserrata*, *Acrostichum aureum*, *Microlepia speluncae*, *Pityrogramma calomelanos*, and *Lycopodium cernuum*.

Others that are common to the tropics of Africa and America

are *Dryopteris protensa*, *Xiphopteris serrulata*, *Microsorium lycopodioides*, and *Asplenium formosum*. These species are all found in other parts of the African continent and its islands. No American species has been found in Liberia that is not found elsewhere in Africa.

A large number of species are either widely distributed over the continent of Africa or else have close relatives in East and Central Africa. Three species which have been found in Liberia are interesting for the fact that they have hitherto been reported only from distant parts of the continent. These are *Diplazium sulcinervium*, reported from Tanganyika, Uganda, and the Belgian Congo, *Antrophyum immersum*, known from East Africa and the Mascarenes, and *Elaphoglossum Deckenii*, from East Africa.

Acknowledgments

This study began during the fall of 1948, by means of facilities made available to me by the Gray Herbarium of Harvard University, and with the very generous aid of the late Charles Alfred Weatherby. I am greatly indebted to him for his help and encouragement. In 1952 I continued the work at the Gray Herbarium, and was always given most courteous assistance by Dr. Reed C. Rollins, Director, and by the other members of the staff. Both Dr. Rollins and Dr. Foster have taken much trouble with the final preparation of the manuscript since I left the country. I thank them.

During March, 1952, there was a very fortunate opportunity to spend some time in the British Museum (Natural History) and study their herbarium-material. I appreciate this privilege, and the help afforded me by members of the staff. I am particularly grateful to Mr. A. H. G. Alston for his help at that time, as well as for many identifications made for me over the period 1948-1953, and for reading the manuscript.

In the same month, it was possible for me to visit the Herbarium of the Royal Botanic Gardens, Kew, and look over the West African fern-specimens there. I want to thank Mr. F. Ballard for his interest and helpful suggestions, and especially for allowing me to publish in this paper his description of the new species, *Ctenopteris punctata*.

My thanks are also due to Mr. C. V. Morton of the Smithsonian Institution for his help and for the loan of Cook's specimens. I appreciate the responses from others with whom I have corresponded: Dr. E. B. Copeland, Dr. J. Mildbraed, and Mme. Tardieu-Blot. I am indebted to other collectors cited in the paper, especially to Dr. Baldwin.

Several Americans resident in Liberia have given me assistance of one kind or another. I am grateful to them, to the other members of the Ganta Mission staff for their tolerant indulgence of my hobby, and most of all to my husband, Dr. George W. Harley, for his intelligent interest and his cooperation during many field-trips.

TABLE OF SPECIES AND DISTRIBUTION

HYMENOPHYLLACEAE

TRICHOMANES AFRICANUM Christ. Montserrado Co.: Mt. Coffee, *Cook 6*. Sinoe Co.: 25 miles up north side of Sanguin River, *Baldwin 11368*; Truo, *Baldwin 11393, 11394*. Sanoquelle Dist.: near Sanoquelle, *Baldwin 13131, 9501*; Kitomu, *Baldwin 13139*; Bilimu, *Harley F192*.

An epiphyte on tree-trunks and twigs, in damp shade of original forest. It also grows occasionally on moss-covered rocks. This species and several others of the same genus, being scarcely larger than the mosses among which they grow, are easily overlooked by a casual observer. They protect themselves during dry periods by curling up, but expand again in moisture.

TRICHOMANES CHAMAEDRYS Taton. Montserrado Co.: Bushrod Is., *Baldwin 13070A*. Boporo Dist.: Gola Forest, *Buting s. n.* Sanoquelle Dist.: Bilimu, *Harley F105, F195A, F213*.

On wet ledges and tree-trunks in deep forest, damp ravines, etc. This species is often not distinguished from *T. erosum*, with which it may be closely associated. Both have simple fronds, less than an inch long. In the field, *T. chamaedrys* is seen to differ in the thinner texture and crisped edges of its frond, and in the more pilose rhizome.

TRICHOMANES CHEVALIERI Christ. Sanoquelle Dist.: Tondi-Kulapa road, *Harley F146*; Wanau, *Harley F203*.

On tree-trunks.

TRICHOMANES CLARENCEANUM Ballard. Sanoquelle Dist.: Bilipia, *Harley F215.*

This species was growing on the base of a cliff.

TRICHOMANES CRISPIFORME Alston. Sinoe Co.: Butaw, *Baldwin 11492.*

"Epiphytic on the upper branches of a forest tree."

TRICHOMANES CUPRESSOIDES Desv. Sanoquelle Dist.: Bilimu, *Harley F63, F78, F104, Baldwin 9613.*

On damp rocks and ledges in the forest. More divided than *T. guineense.* Some fronds are proliferous at the tips. The fronds are very thin and curl badly in drying.

TRICHOMANES EROSUM Willd. Montserrado Co.: Bushrod Is., *Baldwin 13343;* Mt. Coffee, *Cook 75A, 506.* Sinoe Co.: Kulo, *Baldwin 12350A.* Salala Dist.: Piata, *Baldwin 12202A, Linder 1036.* Sanoquelle Dist.: Bilimu, *Harley F105A, F106, F195, Baldwin 9585, 9617A.* Tappita Dist.: Tappita, *Harley F141.* Tchien Dist.: Satro Mt., *Winne 560.* Webo Dist.: Webo, *Baldwin 6103B.*

On dripping tree-trunks, or rocky ledges in the forest, usually associated with mosses, sometimes with *T. chamaedrys.* The simple fronds vary in length from ½ inch to nearly 2 inches. The rhizome is slender and wiry. It is probably the commonest of the small epiphytic species of *Trichomanes.*

TRICHOMANES GUINEENSE Afzel. (*T. batrachoglossum* Copel.). Montserrado Co.: Mt. Coffee, *Cook 4, 392;* Suey, *Cook 62;* Firestone Plantation, *Harley F90A, Cooper 38.* Grand Bassa Co.: Grand Bassa, *Dinklage 1618;* across the river from River Cess, *Baldwin 11293;* 25 miles up north side of Sanguin River, *Baldwin 11376.* Boporo Dist.: Boporo, *Cook 72;* Kondesu, *Baldwin 10669;* Moylakwele, *Linder 1291.* Kolahun Dist.: Genne Loffa, *Baldwin 12087.* Sanoquelle Dist.: Ganta, *Harley F18, F51;* Kitomu, *Harley F163;* near Sanoquelle, *Baldwin 13137.* Tappita Dist.: Tappita, *Baldwin 9102, Winne 495, 510.*

Terrestrial, in damp shade, often near a stream. This species and *T. cupressoides* grow in wet places. Both have a deltoid frond with petiole, and are larger and more compound than the epiphytic species. Rather common.

TRICHOMANES LIBERIENSE Copel. Montserrado Co.: Bushrod Is., *Baldwin 13070;* Mt. Coffee, *Cook 2;* Firestone Plantation near Du River, *Linder 180.* Sanoquelle Dist.: near Wanau, *Harley F139;* Tondi-Kulapa road, *Harley F147;* Gbeidin, *Harley F204.*

Epiphytic, in heavy damp shade. Cook found it "on forest trees 40 feet from the ground", but it also grows commonly on

lower trunks. The smallest of the Liberian species of *Trichomanes*. Each tiny frond bears a single fruiting organ. (See Copeland, 1933, Plate 9).

TRICHOMANES MANNII Hook. Montserrado Co.: Mt. Coffee, *Cook 75*. Salala Dist.: Piata, *Baldwin 12201*. Sanoquelle Dist.: Sanoquelle, *Baldwin 9526*; Bilimu, *Harley F194*. Tchien Dist.: Satro Mt., *Winne 460*.

A small epiphyte on the trunks of forest-trees.

TRICHOMANES METTENII Christ. Sanoquelle Dist.: south of Kitomu, *Harley F155*.

Another species associated with mosses on tree-trunks, of the same group as *T. Mannii* and *T. Chevalieri*.

HYMENOPHYLLUM CILIATUM (L.) Swartz. Sinoe Co.: Kulo, *Baldwin 11398, 11424*. Sanoquelle Dist.: Bilimu, *Harley F191, 1985*.

This species may be found as an epiphyte on forest-trees, or growing on damp ledges. It is rather uncommon. The first specimen from Bilimu is scanty and sterile. Mr. Alston thinks it may possibly be *H. splendidum* v. d. B.

HYMENOPHYLLUM KUHNII C. Chr. Sanoquelle Dist.: Bilimu, *Harley F193, F214, 1982*.

This was found on the trunk of a forest-tree which had been blown down. Mr. Alston calls it "a small form resembling *H. polyanthos*." Further collections may reveal fronds of a more typical length.

CYATHEACEAE

CYATHEA CAMEROONIANA Hook. Boporo Dist.: Gola Forest, *Bunting s. n.* Sanoquelle Dist.: Bilipia, *Harley F54*; Bilimu, *Harley F62, F85*; Kitomu, *Harley F165*. Webo Dist.: Diebla, *Baldwin 6281*; Toroke, *Baldwin 6724*.

A low tree-fern with "trunk" from 2 to 5 feet long, growing in swamps and damp valleys in the mountains. The bipinnate fronds have rather coarse rectangular pinnules.

CYATHEA MANNIANA Hook. Kolahun Dist.: Kailahun, *Baldwin 10151*. Sanoquelle Dist.: ravine northeast of the summit of Bilimu, *Harley F55*.

A tree-fern with the habit of a slender palm, attaining a height of 25-30 feet. The stem and base of the frond armed with stout thorns. Fronds to 10 feet long, finely divided, the ultimate divisions less than 1 cm. long.

POLYPODIACEAE

DRYOPTERIS BUCHOLZII (Kuhn) C. Chr. Montserrado Co.: White Plains, *Cook 48, 49.* Kakata Dist.: Kakata, *Harley F94.* Sanoquelle Dist.: Gbeidin, *Harley F205*; Wanau, *Harley F226.*

Terrestrial, in damp shade.

DRYOPTERIS CURRORI (Mett.) O. Ktze. Sanoquelle Dist.: Bilimu, *Harley F58, F59, F175.*

Terrestrial, on wooded mountainside. In habit somewhat suggesting *Microlepia speluncae.* Fronds sometimes bud and root near the tips, and daughter-plants may develop to a considerable size while still attached to the parent.

DRYOPTERIS DENTATA (Forsk.) C. Chr. Montserrado Co.: Mt. Coffee, *Cook 159*; Firestone Plantation, *Linder 225.* Maryland Co.: Firestone-Cavalla River Plantation, *Harley F96* (coll. Marie Lotz). Sanoquelle Dist.: Gbeidin, *Harley F170.*

Terrestrial, in partial shade.

DRYOPTERIS DEWEVREI Christ ex Bonap. Montserrado Co.: Mt. Coffee, *Cook 1, 93*; Firestone Plantation, *Harley F87, F88*; sine loc., *Cook 7, 38, 39, 92.* Maryland Co.: Cape Palmas, *Dinklage 2621.* Sanoquelle Dist.: Ganta, *Harley F70, F39A, F42, F50*; Gbeidin, *Harley F169*; Bilimu, *Harley F188.* Webo Dist.: Palipo, *Baldwin 6638.*

Terrestrial, growing in a variety of conditions of shade and moisture, such as stream-beds, roadsides, shaded hillsides, etc. It has a creeping rhizome and a simply-pinnate frond. A rather common fern in Liberia.

DRYOPTERIS JENSENIAE C. Chr. Montserrado Co.: Mt. Coffee, *Cook 13, 14*; Muhlenberg, *Cook 57*; White Plains, *Cook 19*; sine loc., *Cook 407, 496, 497, 504, Cook 500, 501* (coll. Straub). Boporo Dist.: Gola Forest, *Bunting s.n.* Sanoquelle Dist.: Bilipia, *Harley F171;* Bobei, *Harley F233.*

Growing in heavy damp shade, sometimes in mud at edge of stream. This fern is conspicuously proliferous. Fronds show many attached daughter-plants with rhizomes nearly as well-developed as that of the parent. These appear to originate in specially-placed sori.

DRYOPTERIS LANIGERA (Kuhn) C. Chr. Sanoquelle Dist.: Ganta, *Harley F33.*

Terrestrial, in damp shade. The under surface bears an extremely fine indumentum.

DRYOPTERIS MICROBASIS (Baker) O. Ktze. Montserrado Co.: Mt. Coffee, *Cook 12*; Firestone Plantation, *Harley F89*.

Terrestrial, in partial shade. Not seen from the interior. This species is simply-pinnate, and is characterized by minute golden glands and white hairs on the lower surface of the pinnae.

DRYOPTERIS PROTENSA (Afzel.) C. Chr. Montserrado Co.: Monrovia, *Planer s. n.*, *Massey 50, 67*, *Dinklage 2212*; Mt. Coffee, *Cook 16, 64*; Muhlenberg, *Cook 56*; sine loc., *Cook 386, 456, 457, 460, 461, 464, 466*. Grand Bassa Co.: Grand Bassa, *Dinklage 1603*. Sinoe Co.: 25 miles up north side of Sanguin River, *Baldwin 11379*; Sino, *Sim s. n.* Maryland Co.: Cape Palmas, *Ansell* (in 1842); Firestone-Cavalla River Plantation, *Baldwin 6011*. Boporo Dist.: Fayapulu, *Linder 1143*. Sanoquelle Dist.: Ganta, *Harley F4, F5, F35*; Sanoquelle, *Winne 126*; Bilimu, *Baldwin 9577*, *Harley F182*. Tchien Dist.: Gletown, *Baldwin 6766, 6796*. Webo Dist.: Webo, *Baldwin 6093*; Diebla, *Baldwin 6298*. There are two unnumbered specimens at the Gray Herbarium from the herbarium of Thomas Moore, marked Liberia, and dated 1897 and 1899.

On the ground, in shade or partial shade. Very common along forest-paths. It adapts itself to a considerable variety of conditions, from heavy damp shade in deep forest to semi-open country. It shows a good deal of variation, both as between collections made in different localities and also as between the individuals growing in the same colony. See *Baldwin 6766* for a series taken from a single colony.

DRYOPTERIS PROTENSA var. SPECIOSA (Mett.) C. Chr. Montserrado Co.: Monrovia, *Cook 21*: Mt. Coffee, *Cook 20, 22, 23, 24, 25, 55*; Firestone Plantation, *Linder 220*; sine loc., *Cook 348, 455, 458, 459, 462, 463, 465*. Sanoquelle Dist.: Ganta, *Harley F92*, *Baldwin 12084*; Sanoquelle, *Winne 164*; Bilimu, *Harley F237*. Tappita Dist.: Tappita, *Baldwin 9099*, *Harley F142*, *Winne 498*. Tchien Dist.: Gletown, *Baldwin 6741*; Zeahtown, *Baldwin 6935*. Webo Dist.: Diebla, *Baldwin 6293*; Palipo, *Baldwin 6613*; Mnanulu, *Baldwin 6060, 6048*.

Habit same as var. *protensa*. The frond is more divided.

DRYOPTERIS QUADRANGULARIS (Fée) Alston. Montserrado Co.: Mt. Coffee, *Cook 3*; sine loc., *Cook 37, 42*. Sanoquelle Dist.: Gbeidin, *Harley F166, F167*; Bilimu, *Harley F190*.

Terrestrial, on shaded slopes.

DRYOPTERIS SECURIDIFORMIS (Hook.) C. Chr. Montserrado Co.: White Plains, *Cook 18*. Kolahun Dist.: Kailahun, *Bequaert 68*; Bolahun,

Earthy misc. iv. Sanoquelle Dist.: Bilimu, *Harley F75, F102, F178, F179.* Tappita Dist.: near Tappita, *Harley F143.*

In very wet places, frequently in rocky stream-beds.

DRYOPTERIS STRIATA (Schumach.) C. Chr. Montserrado Co.: *Cook 11.* Gbanga Dist.: Gbanga, *Linder 477.* Sanoquelle Dist.: Sanoquelle, *Winne 38*; Ganta, *Harley F40, F79.* Tchien Dist.: Satro Mt., *Winne 450.* Webo Dist.: Webo, *Baldwin 6106.*

Terrestrial. A rather stiff coarse fern, growing along the borders of swamps and in damp places, sometimes 6 feet high.

TECTARIA ANGELICIFOLIA (Schumach.) Copel. Maryland Co.: Firestone-Cavalla River Plantation, *Harley F95* (coll. Marie Letz). Sanoquelle Dist.: Ganta, *Harley F91*; Kanwi, *Harley F199.* Webo Dist.: Yratoke, *Baldwin 6248.*

Terrestrial, in damp shade.

TECTARIA FERNANDENSIS (Baker) C. Chr. Maryland Co.: Cape Palmas, *Dinklage 2671.* Sanoquelle Dist.: Bilimu, *Harley F61, F200.*

Same habitat as the preceding. This fern often bears bulbils on the upper surface, the lower surface, or both.

BOLBITIS ACROSTICHOIDES (Afzel.) Ching. Montserrado Co.: Mt. Coffee, *Cook 30, 67A, 168*; sine loc., *Cook 452, 489, 491, 493, 495.* Salaba Dist.: Peahtah, *Linder 968.* Sanoquelle Dist.: Ganta, *Harley F12, F168, Winne 438*; Bilimu, *Harley F56, F77*; Dubo, *Baldwin 9482.* Tchien Dist.: 20 miles east of Zwedru, *Baldwin 7064*; Satro Mt., *Winne 465, 473, 480.*

Terrestrial, in forest, on damp hillisdes, and in moderate shade. Rather common. The terminal segment is usually much elongated, and frequently takes root at the tip.

BOLBITIS AURICULATA (Lam.) Ching. Montserrado Co.: Mt. Coffee, *Cook 34, 41, 84.* Sanoquelle Dist.: Bilimu, *Harley F73, F76A, F111, F180, F114A.* Webo Dist.: Gbauia, *Baldwin 6709.*

On damp mountainsides, near streams, but not actually in the stream-bed as is *B. fluviatilis.*

BOLBITIS FLUVIATILIS (Hook.) Ching. Montserrado Co.: Mt. Coffee, *Cook 138, 167.* Sanoquelle Dist.: Gbeidin, *Harley F152*; Bilimu, *Harley F76, F114.* Tchien Dist.: 4 miles north of Pola Chensalar, *Winne 490*; Satro Mt., *Winne 561.* Sine loc., *Linder s. n.*

A plant of very wet places, frequently on rocks in a running stream. The color of the frond is a dark greyish-green. The coarse divisions of the frond are less complete than in the other species of *Bolbitis.*

BOLBITIS GEMMIFERA (Hieron.) C. Chr. Salala Dist.: Peatah, *Linder 976*. Sanoquelle Dist.: Ganta, *Harley F15, F86*; Bilimu, *Harley F120*.

Terrestrial, in forest-shade. The pinnae are somewhat wider than those of *B. acrostichoides*. The buds in this species are borne at the base of the terminal segment.

BOLBITIS HEUDELOTII (Bory) Ching ex C. Chr. Montserrado Co.: Mt. Coffee, *Cook 50, 65, 66, 82*. Boporo Dist.: Boporo, *Cook 67*. Sanoquelle Dist.: Sanoquelle, *Winne 85*. Webo Dist.: Webo, *Baldwin 6096*.

This species, like *B. fluviatilis*, may be found in stream-beds where it is often submerged. Cook's no. 82 shows how continued immersion may cause changes in texture and dissection of the pinnae.

BOLBITIS SALICINA (Hook.) C. Chr. Montserrado Co.: Mt. Coffee, *Cook 31, 163, 169*. Boporo Dist.: Gola Forest, 10 miles south of Gene, *Bunting s. n.*; So-Banga, *Linder 1150, 1154* (?). Sanoquelle Dist.: Gbeidin, *Harley F159*; Bilimu, *Harley 1992*.

This is another species of stream-beds and very wet places.

OLEANDRA DISTENTA Kunze. Montserrado Co.: Monrovia, *Massey 56, Cook 171A, Dinklage 2484*; Firestone Plantation, *Linder 110*. Grand Bassa Co.: between Grand Bassa and River Cess, *Dinklage 1922*. Sanoquelle Dist.: Ganta, *Harley F10, Winne 446, Baldwin 12081*; Sanoquelle, *Winne 58*. Tchien Dist.: Gretown, *Baldwin 6908*; 20 miles east of Zwedru, *Baldwin 7062*.

Epiphytic, often forming a tangle around the base of oil-palms in a clearing; or masses of growth high in the forest canopy.

ARTHROPTERIS MONOCARPA (Cordem.) C. Chr. Sanoquelle Dist.: Bilimu, *Harley F177*; Gbeidin, *Harley F223*.

On tree-trunks or mossy boulders in very damp places.

ARTHROPTERIS OBLITERATA (R. Br.) J. Sm. Tchien Dist.: Chensalar, *Winne 489*; Satro Mt., *Winne 469*. Webo Dist.: Yratoke, *Baldwin 6262*.

Climbing on trees in deep forest. Not common.

ARTHROPTERIS ORIENTALIS (Gmel.) Posth. Montserrado Co.: Monrovia, *Cook 8, 9, 10, Harley F208, Dinklage 2184, 2729*. Vonjama Dist.: Nekabozu, *Baldwin 9956*. Sanoquelle Dist.: Gbau, *Baldwin 9399*; Wanau, *Harley F202*.

On trees or stones. Cook (1895) comments that he found it "only in stone walls in Monrovia"; *Baldwin 9399* was growing

on a cola-tree near the edge of the village; at Wanau, I found it on the trunk of a large forest-tree felled by the sawyers.

NEPHROLEPIS BISERRATA (Swartz) Schott. Montserrado Co.: Monrovia, *Massey 55, 72, Baldwin 5826, 5848*; Mt. Coffee, *Cook 40*; Firestone Plantation, *Cooper 22A*; Port Marshall, *Frazer 3, Knudsen 5*; sine loc., *Cook 35, 36, 91, 380, 396, 397.* Grand Bassa Co.: Grand Bassa, *Dinklage 2280.* Kolahun Dist.: Bolahun, *Earthy 23.* Sanoquelle Dist.: Sanoquelle, *Winne 60, 84*; Ganta, *Harley F1, F3, F27.* Webo Dist.: Mnanulu, *Baldwin 6043.*

This species is equally at home in an epiphytic or a terrestrial habitat. It flourishes on the trunks of oil-palms, along the edges of swamps, and in hollows in the deep forest. It will also grow in clearings in full sun. It is one of the commonest ferns in Liberia. It is used by natives in treatment of snakebites and of urinary complaints (Harley, 1941).

NEPHROLEPIS UNDULATA (Afzel.) J. Sm. Montserrado Co.: Monrovia, *Cook 5, Dinklage 2230, 2730*; Firestone Plantation, *Cooper 22.* Boporo Dist.: Banga, *Linder 1161.* Kolahun Dist.: Bolahun, *Earthy misc. V.* Sanoquelle Dist.: Sanoquelle, *Winne 143*; Ganta, *Harley F2, Baldwin 12082*; Kitomu, *Harley F157*; Sopia, *Winne 110*; Dubo, *Baldwin 9468.* Tchien Dist.: on rock outcrop 20 miles east of Zwedru, *Baldwin 7075.*

Habitat the same as the preceding. Baldwin and Winne have noted it particularly on the top of sparsely covered rocky outcrops. It has a narrower frond than the preceding species, and dies out during the dry season. The auricles at the base of the pinnae project beneath the axis, forming a sort of keel running the whole length of the frond. In the herbarium, in the tropics, this is one of the few native species that are badly damaged by insects.

DAVALLIA CHAEROPHYLLOIDES (Poir.) Steud. Boporo Dist.: Gola Forest, *Bunting s. n.* Gbanga Dist.: Gbanga, *Linder 798.* Sanoquelle Dist.: Ganta, *Harley F13*; Dubo, *Baldwin 9471*; Wanau, *Harley F201.*

Epiphytic on oil-palms or forest-trees.

MICROLEPIA SPELUNCAE (L.) Moore. Montserrado Co.: Mt. Coffee, *Cook 74, 136*; Firestone Plantation, *Harley F122.* Sanoquelle Dist.: Ganta, *Harley F48, F138.*

Terrestrial, in wet shaded places. The frond is large, but very delicate and friable.

DIPLAZIUM PROLIFERUM (Lam.) Thouars [5]. Montserrado Co.: Mt. Coffee, *Cook 123, 469*. Boporo Dist.: Gola Forest, *Bunting* (24/ v/ 10). Sanoquelle Dist.: Bilimu, *Harley F74*. Webo Dist.: Diebla, *Baldwin 6329;* Toroke, *Baldwin 6723*.

Terrestrial, in damp valleys in the forest. In favorable locations, this species reaches a height of 6 feet or more. Along the rachis it bears frequent adventitious buds which develop into young plants before falling off.

DIPLAZIUM SAMMATTII (Kuhn) Christ. Montserrado Co.: Mt. Coffee, *Cook 70*. Boporo Dist.: Boporo, *Cook 71*. Sanoquelle Dist.: Ganta, *Harley F39, F124*.

Terrestrial. It is found growing along the edge of a stream where it is frequently inundated.

DIPLAZIUM SULCINERVIUM (Hieron.) C. Chr. Sanoquelle Dist.: Bilimu, *Harley F68, F113*.

This fern grows on the forest-floor on damp mountain-sides. Unlike the two preceding species, it has a compound frond which is rather delicate, wilting easily. This species has been reported from Tanganyika, Madagascar, and the Belgian Congo.

ASPLENIUM AETHIOPICUM (Burm.) Bech. Tchien Dist.: 20 miles east of Zwedru, *Baldwin 7071*.

This fern was found growing on rock.

ASPLENIUM AFRICANUM Desv. Montserrado Co.: "Montserrado", *Planer s. n.*; Monrovia, *Cook 125*; White Plains, *Cook 126*; Muhlenberg, *Cook 100*; Mt. Coffee, *Cook 77, 124, 127*; Firestone Plantation, *Linder 58*; sine loc., *Cook 382, 384*. Grand Bassa Co.: 10 miles inland from mouth of Cess River, *Baldwin 11239*; between Grand Bassa and River Cess, *Dinklage 1921*. Sanoquelle Dist.: Ganta, *Harley F29*; Siaple, *Baldwin 9461*. Gbanga Dist.: Yila, on St. John River, *Baldwin 9128*. Tchien Dist.: Satro Mt., *Winne 472*. Webo Dist.: Webo, *Baldwin 6107*; Mnanulu, *Baldwin 6037*.

An epiphyte, often growing on the higher branches of forest-trees. The lanceolate fronds are 2 or 3 feet long.

ASPLENIUM BARTERI Hook. Montserrado Co.: Mt. Coffee, *Cook 131, 133, 144*; White Plains, *Cook 132*; Firestone Plantation, *Linder 85*; sine loc., *Cook 32, 45, 76, 79, 85, 130, 390, 395, 454, 455, 488*.

5) Ballard has made a correction of the authority commonly quoted for this combination. He shows that it should be *D. proliferum* (Lam.) Kaulf. Kew Bull. 1954, No. 4.

Sinoe Co.: 25 miles up the Sanguin River, *Baldwin 11367*; Kulo, *Baldwin 11423*. Boporo Dist.: Zuie, *Baldwin 12095, 12097*; Fayapulu, *Linder 1144*. Kolahun Dist.: Vahun, *Baldwin 10235*; Mao River, near Nyandamolahun, *Bequaert 74*. Vonjama Dist.: Vonjama, *Baldwin 9919*. Sanoquelle Dist.: Ganta, *Harley F25*; Kitomu, *Baldwin 13140*; Bilimu, *Harley F65, Baldwin 9616, 9628*. Webo Dist.: Webo, *Baldwin 6110*.

A rather common epiphyte of the forest. There is a good deal of variation in the shape of the pinnae. Many of the fronds take root at the tip.

ASPLENIUM DIPLAZISORUM Hieron. Sanoquelle Dist.: Bilimu, *Harley F101*; Dubo, *Baldwin 9470*.

Growing in humus on a ledge, or on rotting wood. The fresh specimen was notable for its deep-green color.

ASPLENIUM DREGEANUM Kunze. Kolahun Dist.: Vahun, *Baldwin 10217*; Mao River, near Nyandamolahun, *Bequaert 75*. Sanoquelle Dist.: Sanoquelle, *Baldwin 9496*; Bilimu, *Harley F64, Baldwin 9588, 9526B*; Sopia, *Winne 116*. *Dinklage 1607*, from Grand Bassa, cited (Dinklage, 1937) as *A. auriculatum* may belong here, but I have not seen it.

Epiphytic, like the last, and more finely-dissected. Some of the segments are so small that one is entirely occupied by a fruit-dot. This species multiplies by modified fronds, forming pseudo-stolons.

ASPLENIUM EMARGINATUM Beauv. Sanoquelle Dist.: Bilipia, *Harley F81*.

Terrestrial, growing on the edge of a swamp. Not common. Buds form on the tips of pinnae, at the base of a V-shaped sinus.

ASPLENIUM FORMOSUM Willd. Vonjama Dist.: Nekabozu, *Baldwin 9954*. Sanoquelle Dist.: Dubo, *Baldwin 9477*; Gbeidin, *Harley F225*; Bilimu, *Harley F173*; Sopia, *Winne 118*.

On tree-trunks, or on large boulders partially exposed to sun.

ASPLENIUM GEPPII Carruth. (*A. anisophyllum* Kunze). Montserrado Co.: Mt. Coffee, *Cook 143*. Sanoquelle Dist.: Bilimu, *Harley F172, F98*; Dubo, *Baldwin 9486*.

An epiphyte of the forest. This fern varies greatly in the shape of the pinnae, and in the length of the frond (from 5 or 6 inches to 2 feet). It may be recognized by the short thick sori.

ASPLENIUM HEMITOMUM Hieron. Montserrado Co.: Mt. Coffee, *Cook 129*; Suey, *Cook 106*; sine loc., *Cook 29*. Cape Mount Co.: Genne

Tanyehun, *Baldwin 10753*. Sinoe Co.: Truo, *Baldwin 11384*. Boporo Dist.: Kle [Clay?], *Baldwin 10633*; Ba, on Mano River in Gola Forest, *Baldwin 10723*. Kolahun Dist.: Vahun, *Baldwin 10249*. Vonjama Dist.: near Vonjama, *Baldwin 9922*; Nekabozu, *Baldwin 9985A*; Wohmen, *Baldwin 10104*. Salala Dist.: Dobli Is., *Bequaert 18*. Gbanga Dist.: Gbanga, *Linder 777*; Yila, on St. John River, *Baldwin 9141*. Sanoquelle Dist.: Ganta, *Harley F24*; Bilimu, *Harley F72, F184*; Kitomu, *Baldwin 13141*.

Epiphytic; often found on dead logs as well as on tree-trunks. Mature fronds vary considerably in length.

ASPLENIUM MEGALURA Hieron. Vonjama Dist.: Nekabozu, *Baldwin 9985*. Sanoquelle Dist.: Bilimu, *Harley F67*; Kitomu, *Harley F210*.

An epiphyte of the forest, usually in the higher branches. The pairs of pinnae at right angles to the rachis, suggesting the wings of a butterfly, are characteristic. The rachis is stiff and wiry, and the pinnae coriaceous. Pinnae on a mature frond are 3-lobed, the middle lobe narrowly triangular. Juvenile leaflets are simple, obconic or fan-shaped.

ASPLENIUM PAUCIJUGUM Ballard. Montserrado Co.: Mt. Coffee, *Cook 139, 140, 141, 142, 148, 490*. Kolahun Dist.: Karmadhun, *Baldwin 10172*. Sanoquelle Dist.: Bilimu, *Harley F66, F217*; Sanoquelle, *Baldwin 9558, 9542*; Dubo, *Baldwin 9478*; Ganta, *Harley F148*; Gbeidin, *Harley F220*.

Terrestrial, in wet shaded locations. Often in stream-beds. Occasionally, it becomes epiphytic at the base of tree-trunks in places where it is common. This interesting West African fern has some simple fronds, and some with 3 or 5 segments. It often takes root at the tip of the terminal segment. *Cook 148* shows an unusual degree of lobing, due, perhaps, to its having grown in an abnormal situation. It is Mr. Alston's opinion that this species cannot be satisfactorily distinguished from *A. variabile*. In this instance, I am following Mr. Ballard, who has seen nearly all of the above numbers and calls them *A. paucijugum*.

ASPLENIUM VARIABILE Hook. Montserrado Co.: Mt. Coffee, *Cook 134, 135, 145, 146, 147*. Sinoe Co.: 25 miles up north side of Sanguin River, *Baldwin 11371* Duo, *Baldwin 11333*. Kolahun Dist.: Genne Loffa, *Baldwin 12089*. Gbanga Dist.: Gbanga, *Linder 660*. Salala Dist.: Piata, *Linder 958*. Sanoquelle Dist.: Gbeidin, *Harley F151, F221*; south of Kitomu, *Harley F153*; Bilimu, *Harley F176*. Webo Dist.: Diebla, *Baldwin 6316*.

Terrestrial, in very wet locations, often growing on rocks in a stream. The simple fronds vary, especially in the amount of cutting of the margin, and are sometimes lobed nearly to the midrib near the base.

LOMARIOPSIS GUINEENSIS (Underw.) Alst. Montserrado Co.: Mt. Coffee, *Cook* 58, 137. Sinoe Co.: 25 miles up the Sanguin River, *Baldwin 11369*. Sanoquelle Dist.: Bilimu, *Harley F57, F97, F97A*.

Climbing on trees, occasionally on ledges in the forest. Rooted in the ground at the base of its "host", this fern clings by its supporting rootlets, and ascends for distances varying from a few feet on young saplings, to perhaps 100 feet on old forest-trees. It has both simple and pinnate fronds.

LOMARIOPSIS PALUSTRIS (Hook.) Mett. Montserrado Co.: Mt. Coffee, *Cook 102*. Boporo Dist.: Tawata, *Baldwin 10284*. Salala Dist.: Kakata, *Harley F93*. Gbanga Dist.: Gbanga, *Linder* 746. Sanoquelle Dist.: Gbeidin, *Harley F198*. Webo Dist.: Webo, *Baldwin* 6112; Diebla, *Baldwin* 6315; Sarbo, *Baldwin* 6388.

This species grows on rocks and mud in stream-beds. It has simple, narrow, dimorphic fronds.

LOMARIOPSIS ROSSII Holttum. Montserrado Co.: Mt. Coffee, *Cook* 46, 87, 166. Boporo Dist.: Zuie, *Baldwin 12090*. Sanoquelle Dist.: Ganta, *Harley F26, F121, Winne* 436.

This species is very similar to *L. guineensis* in its habitat and habit. It may be distinguished in the field by the winged rachises and the wider base of the leaflets.

PITYROGRAMMA CALOMELANOS (L.) Link. Montserrado Co.: Firestone Plantation, *Baldwin* 5922; Brewerville, *Winne* 402. Sanoquelle Dist.: Sanoquelle, *Winne* 148; Dinamu, *Harley F46*. Tappita Dist.: Tappita, *Baldwin* 9106.

Terrestrial; often found on gravel-banks, sides of drainage-ditches, etc. This is the "silver-fern" of the American tropics, which seems completely naturalized in Liberia.

PELLAEA DONIANA (J. Sm.) Hook. Sanoquelle Dist.: Ganta, *Harley F45*; Sopia, *Winne 123*. Tchien Dist.: 20 miles east of Zwedru, *Baldwin 7058*; Satro Mt., *Winne 466*.

Terrestrial, often on rocky hillsides in partial shade.

ADIANTUM PHILIPPENSE L. Gbanga Dist.: Kassata, *Linder* 831. Sanoquelle Dist.: Bilimu, *Harley F174*.

Growing on rocks. The Linder specimen was "on moss-covered rocks in original forest." At Bilimu, it was found on the broken face of the cliff in a more exposed location.

ADIANTUM VOGELII Mett. Montserrado Co.: Suey, *Cook 60*; White Plains, *Cook* 59; Mt. Coffee, *Cook 158*. Cape Mount Co.: Mano River, below Jui, *Bunting* (23/ iv/ 10); Cape Mount, *Dinklage* 2568, 2577. Gbanga Dist.: Gbanga, *Linder* 745. Sanoquelle Dist.: Ganta, *Harley F38*. Webo Dist.: Palipo, *Baldwin 6510*.

Terrestrial. This species is often found along the bank of a stream where it is submerged at high water.

PTERIS ATROVIRENS Willd. Montserrado Co.: White Plains, *Cook 90, 170*. Grand Bassa Co.: Grand Bassa, *Dinklage 1604*. Maryland Co.: Cape Palmas, *Ansell s. n.* Kolahun Dist.: Bolahun, *Earthy miscIII*. Sanoquelle Dist.: Ganta, *Harley F11*; Sanoquelle, *Winne* 83. Tchien Dist.: Gletown, *Baldwin* 6745, 6754.

A coarse terrestrial fern, rather common.

PTERIS BURTONI Baker (*P. Johnstoni* Baker). Montserrado Co.: Mt. Serrado, *Wingfield 215*; Suey, *Cook 109*; White Plains, *Cook* 96; Mt. Coffee, *Cook* 95, 95*A*; sine loc., *Cook* 53, 54, 80, 89, 164, 388, 441, 446, 447, 485, 494, 502; Firestone Plantation (Du River), *Linder* 265. Maryland Co.: Firestone-Cavalla River Plantation, *Baldwin* 6006. Gbanga Dist.: Gbanga, *Linder* 454. Sanoquelle Dist.: Ganta, *Harley F28, F52*. Tappita Dist.: Tappita, *Harley F144, Winne* 502. Webo Dist.: Mnanulu, *Baldwin* 6055.

A terrestrial species, found in damp forest-shade. It is conspicuous for its polymorphic fronds, some having entire pinnae, others, pinnae which are deeply cut. Both types of fronds may be fertile. Buds are frequently found at the base of a terminal segment.

PTERIS PTERIDIOIDES (Hook.) Ballard (*P. brevisora* Baker). Sanoquelle Dist.: Bilimu, *Harley F83*.

This species grows on the forest-floor on a rocky hillside. It is more graceful and more finely cut than the other species of *Pteris* mentioned here. In this particular station, it was fairly abundant.

PTERIS CATOPTERA Kunze. (*P. quadriaurita* Retz. *sens. lat.*). Montserrado Co.: Monrovia, *Dinklage* 2237. Sanoquelle Dist.: Ganta, *Harley F41*; Bilimu, *Harley F84, F109*.

Terrestrial, usually in open sunny places, sometimes on hilltops.

PTERIS SIMILIS Kuhn. Sanoquelle Dist.: Sakimpa, *Harley F119*; Bilipia, *Harley F218*.

Terrestrial, in shade at the edge of swamps. There are sometimes buds at the base of the terminal leaflet.

PTERIS TRIPARTITA Swartz. Montserrado Co.: Monrovia, *Cook 88*. Sanoquelle Dist.: Gbau, *Baldwin 9428*.

A tall coarse fern, growing on a sunny hill.

HISTIOPTERIS INCISA (Thunb.) J. Sm. Montserrado Co.: Mt. Coffee, *Cook 17*. Sanoquelle Dist.: near Sakimpa, *Harley F116*.

In cleared ground, roadsides, etc. This species is subscandent, 6 feet or more in height. The stipe is shining, red-brown, and brittle, as much as a centimeter in diameter. The lateral branches may be as much as 3 feet long.

ANISOSORUS OCCIDENTALIS (Baker) C. Chr. Sanoquelle Dist.: Bilimu, *Harley F112*; Gbeidin, *Harley F158*.

On wet rocks and ledges. The first specimen was growing on a dripping ledge in a mountain-ravine; the other on the rock-abutment under a bridge in a forested area.

LONCHITIS CURRORI (Hook.) Mett. Montserrado Co.: Mt. Coffee, *Cook 128, 165*. Grand Bassa Co.: Grand Bassa, *Dinklage 1605*. Gbanga Dist.: Gbanga, *Linder 640*. Sanoquelle Dist.: Ganta, *Harley F36*; Bilimu, *Harley F60*. Tchien Dist.: Gletown, *Baldwin 6763*. Webo Dist.: Diebla, *Baldwin 6282*; Mnanulu, *Baldwin 6035*.

Terrestrial, in wet shaded places. The plant often forms dense hummocks in swamps. In favorable positions it grows well over 6 feet. Immature fronds vary considerably from the older fronds. These young simply-pinnate fronds of *L. Currori* seem to have been the basis of Baker's *Pteris Mannii* (see Ballard, 1937).

LONCHITIS REDUCTA C. Chr. Sanoquelle Dist.: Bilimu, *Barker 1178*, *Harley F163*.

On a rocky hillside. Uncommon. My specimen, F163, is a very small young plant, yet mature enough to show a trace of sori. Alone, it might well be taken for a young individual of *L. Currori*, but Barker's material which came from the same location (the crest of the ridge) is more ample, and was determined by Mr. Alston as *L. reducta*. I am, therefore, placing my number here with Barker's.

PTERIDIUM AQUILINUM (L.) Kuhn. Montserrado Co.: Monrovia, *Massey 65*; Bushrod Is., *Winne 17*; Mt. Coffee, *Cook 110*; Firestone Plantation,

Cooper 21; Port Marshall, *Fraser* 4, *Kraemmer* 7. Grand Bassa Co.: near Grand Bassa, *Dinklage* 1620, 1628. Sanoquelle Dist.: Ganta, *Harley F47*; without location, *Millen* 200.

In clearings, old farms, roadsides, etc., often scandent. It is called Strainer Weed by the coast Liberians, because it is made to serve the purposes of a strainer by putting several layers of its branches criss-cross over the top of a cooking vessel. I have also seen it used as a foundation for wreaths and floral pieces. A bunch of the fern is twisted and secured in the form of a ring, and leaves and flowers fastened to this as a base. It is one ingredient in an elaborate mixture used for the treatment of respiratory complaints (see Harley, 1941).

VITTARIA GUINEENSIS Desv. Montserrado Co.: *Massey* 72; Brewerville, *Winne* 379; White Plains, *Cook* 98; Mt. Coffee, *Cook* 28, 108; sine loc., *Linder* 54. Grand Bassa Co.: Grand Bassa, *Dinklage* 1919, 2279; Begwai [6] *Bunting* 114. Vonjama Dist.: Soplima, *Baldwin* 10113. Salala Dist.: Piatah, *Baldwin* 12325*A*. Sanoquelle Dist.: Sanoquelle, *Winne* 117; Ganta, *Harley F8, F82, Baldwin* 12080; Gbeidin, *Harley F164*; Bilimu, *Baldwin* 9623. Tappita Dist.: Tappita, *Baldwin* 9094. Tchien Dist.: Zeatown, *Baldwin* 6989. Webo Dist.: Diebla, *Baldwin* 6317; Mnanulu, *Baldwin* 6054.

Epiphytic, most often on oil-palms, in partial shade. Rather common.

VITTARIA OWARIENSIS Fée. Grand Bassa Dist.: between Grand Bassa and River Cess, *Dinklage* 1920. Sanoquelle Dist.: Ganta, *Harley F140*.

This species, like *V. guineensis*, is found growing on oil-palms. It may be distinguished in the field by the straight narrow fronds without visible midrib, and by lack of color in the young fronds and the base of the stripe of mature fronds. In his notebook, Cook mentioned a species of *Vittaria* "without visible midrib", but no corresponding specimen was found among his collections.

ANTROPHYUM MANNIANUM Hook. Montserrado Co.: Mt. Coffee (?), *Cook* 33, 81. Cape Mount Co.: Genne Tanyehun, *Baldwin* 10730. Boporo Dist.: Zuie, *Baldwin* 12906. Vonjama Dist.: near Vonjama, *Baldwin* 9923; Nekabozu, *Baldwin* 9963. Sanoquelle Dist.: Bilimu, *Harley F100*; Kitomu, *Baldwin* 13142, *Harley F222*. Tchien Dist.: on rock outcrop 20 miles east of Zwedru, *Baldwin* 7063.

6) This town is not shown on the map. It is located on the lower St. John River near the inland boundary of Grand Bassa Co.

On tree-trunks in the forest, usually 20-40 feet from the ground. Occasionally on mossy boulders. The broad, simple, leaf-like fronds of this fern give it a very distinctive appearance on the straight bole of a forest-tree.

ANTROPHYUM IMMERSUM (Bory ex Willd.) Mett. Sanoquelle Dist.: Bilimu, *Harley F216*; Wanau, *Harley F218A, F222, F227.*

The fronds of this species are much smaller than those of the preceding, usually about 3 inches long. It was seen on a large tree fallen in the forest, and was also found in considerable abundance in a grove of cola-trees outside a native village. It has previously been reported from East Africa and the Mascarene Islands.

PLEOPELTIS PREUSSII (Hieron.) Tard. (*Polypodium Preussii* Hieron.) Sanoquelle Dist.: Bilimu, *Harley F99.*

An epiphyte in the forest. Not common.

MICROGRAMMA LYCOPODIOIDES (L.) Copel. (*Polypodium lycopodioides* L.). Montserrado Co.: Monrovia, *Cook* 27, 117, 118, 120, *Dinklage* 2719, *Baldwin* 5938, *Linder* 55; "Montserrado", *Planer* 217, and *s. n.*; 2 miles north of St. Paul River, *Winne* 375; Muhlenburg, *Cook* 99; Mt. Coffee, *Cook* 119; sine loc., *Cook* 378. Grand Bassa Co.: Grand Bassa, *Vogel* 98. Vonjama Dist.: Soplima, *Baldwin* 10046. Sanoquelle Dist.: Ganta, *Harley F21*; Gbau, *Baldwin* 9400. Webo Dist.: Webo, *Baldwin* 6133.

This common fern is found both on trees and on stone-walls, as Cook found it in Monrovia. The fronds are simple and vary from round to linear.

MICROSORIUM PUNCTATUM (L.) Copel. (*Polypodium polycarpon* Cav.) Montserrado Co.: Monrovia, *Cook* 43. Grand Bassa Co.: Grand Bassa, *Dinklage* 2122, *McWilliam s. n.* Maryland Co.: Firestone-Cavalla River Plantation, *Baldwin* 6016. Gbanga Dist.: Gbanga, *Linder* 759. Sanoquelle Dist.: Ganta, *Harley F20*; Sanoquelle, *Winne* 41.

A large coarse epiphyte on forest-trees. From the ground it may be mistaken for *Asplenium africanum.* The sori are very small and abundant.

MICROSORIUM SCOLOPENDRIA (Burm.) Copel. (*Polypodium Scolopendria* Burm.). Montserrado Co.: Monrovia, *Cook* 25, 44, 121, *Baldwin* 5825, *Massey* 24, *Linder* 55, 61; Bushrod Is., *Winne* 196; 2 miles north of St. Paul River, *Winne* 369; Muhlenburg, *Cook* 101; sine loc. *Cook* 381, 406. Grand Bassa Co.: Grand Bassa, *Vogel* 24, *McWilliam s. n.*

(in 1842), *Dinklage 1816* ("var. bipinnatifida"), *Whyte s. n.* Sinoe Co.: Butaw, *Baldwin 11491;* Sino Basin, *Whyte s. n., Sim s. n.* Maryland Co.: Cape Palmas, *Ansell s. n.* (18/vii/41). Sanoquelle Dist.: Ganta, *Harley F9*. Webo Dist.: Diebla, *Baldwin* 6314. Sine loc., *Dinklage s. n.*

An epiphyte, not confined to the high forest. It is common on oil palms. Winne found it growing on the sand under a palm, from which, presumably, it had been detached. The sori are unusually large and are conspicuous for being impressed into the substance of the frond.

DRYNARIA LAURENTII (Christ) Hieron. Montserrado Co.: Mt. Coffee, *Cook 115;* Firestone Plantation, *Baldwin 9219*; Monrovia, *Dinklage 3050*; sine loc., *Linder 57*. Sanoquelle Dist.: Ganta, *Harley F49*; Sanoquelle, *Winne 25*; Bilimu, *Harley F235*. Tchien Dist.: Gletown, *Baldwin 6790*. Webo Dist.: Sarbo, *Baldwin* 6398.

Epiphyte in forest or partial clearing. This genus is well-known for its specialized fronds, which serve to hold a mass of detritus at the base of the plant. These sterile fronds are thin, papery, and persistent, somewhat suggesting oak-leaves, as is indicated by the name of another species of the genus. Another characteristic of the genus is the articulation of the segments of the fertile fronds, which fall away from the midrib after maturity.

XIPHOPTERIS SERRULATA (Swartz) Kaulf. (*Polypodium duale* Maxon) Montserrado Co.: Mt. Coffee, *Cook 122*. Sinoe Co.: Butaw, *Baldwin 11494*; Duo, *Baldwin 11340*; Truo, *Baldwin 11381*. Boporo Dist.: Gola Forest, *Bunting s. n.* (5/vi/10). Sanoquelle Dist.: Bilimu, *Harley F185*. This small epiphyte grows on the upper branches of forest trees.

LOXOGRAMME LANCEOLATA (Swartz) Presl. (*Polypodium loxogramme* Mett.). (*Loxogramme africana* Copel.) Montserrado Co.: Mt. Coffee, *Cook 111*. Vonjama Dist.: Nekabozu, *Baldwin 9962*; Wohmen, *Baldwin 10070*. Sanoquelle Dist.: Wanau, *Harley F80, F149, Baldwin* 9649; Ganta, *Winne* 562, *Harley F229*; Dubo, *Baldwin* 9475; Siaple, *Baldwin* 9442; Bilimu, *Harley F110*; Gbeidin, *Harley F224*.

Epiphytic on tree-trunks in the shade; sometimes on cola trees near a village. This species also grows on boulders in damp situations. The colony at Wanau seems to have consistently smaller fronds than is usual for the species, thus resembling *L. suberosa* Christ.

Ctenopteris villosissima (Hook.) Harley, comb. nov. (*Polypodium*

PLATE 1. CTENOPTERIS PUNCTATA Ballard.

Left, habit sketch x 2. Upper right, portion of pinna showing a sorus x 50. Lower right, single pinna x 20. Drawings by Mrs. C. A. Weatherby.

villosissimum Hook. Spec. Fil. 4: 197 [1862]). Sanoquelle Dist.: Bilimu, *Harley F181, 1978.* Epiphyte on forest trees.

Ctenopteris punctata Ballard, spec. nov.

Rhizoma breve; paleae lanceolatae, rufo-brunneae, sparse et irregulariter pilis minutissimis debilibus laxe fimbriatae, usque 6 mm. longae. *Stipites* 2 mm. longi, pilis rufo-brunneis confertis patentibus 1 mm. longis vestiti. *Frondes* lanceolatae, usque 30 mm. longae, 6 mm. latae, coriaceae, apicem et basim versus sensim angustatae, dimidio costam versus pinnatifidae, utroque pilis brevssimis patentibus plus minusve vestitae et glandulis vesiculosis albis 40-50 μ diametro, 2-3 aggregatis punctatae; laminae lobi basi 2-2.5 mm. lati, obtusi triangulares vel suboblongi, integri, 3-5 soris orbicularibus praediti. Sporangia nuda. **Typus:** LIBERIA: Sinoe Co.: Butaw, on high tree, March 17, 1948, *J. T. Baldwin 11493* (in Herb. Kew).

A curious little epiphyte notable for the minute chalk-white vesicles scattered in groups of 2 or 3 over the lower surface of the frond. A few are present on the upper surface as well. In the dried specimens examined, the vesicles are devoid of liquid contents, but, unlike the vesicular glands of *Atriplex* and others, the wall of the vesicle is rigid and does not collapse on drying. The glands, if glands they be, are subspherical in shape and are faintly striated.

ELAPHOGLOSSUM BARTERI (Baker) C. Chr. Boporo Dist.: Ba (on Mano River in Gola Forest), *Baldwin 10713.* Vonjama Dist.: Nekabozu, *Baldwin 9955.* Sanoquelle Dist.: Sanoquelle, *Baldwin 9491*; Bilimu, *Harley F212*; Ganta, *Harley F230.*

On forest-trees, fallen logs, and forest-debris.

ELAPHOGLOSSUM CLARENCEANUM (Baker) C. Chr. Sanoquelle Dist.: Bilimu, *Harley F189, 1984, Barker 1172.*

Epiphytic in forest.

ELAPHOGLOSSUM CONFORME (Swartz) Schott. Sanoquelle Dist.: Bilimu, *Harley F103, F186.*

An epiphyte, continuing to grow on rotten limbs that have fallen to the ground. Fairly common in deep forest.

ELAPHOGLOSSUM DECKENII (Kuhn) C. Chr. Sinoe Co.: Kulo, *Baldwin 11422.*

Epiphytic on forest-tree. This is a rather small sterile plant and cannot be absolutely identified. Mr. Alston would place it here, in a species previously found in East Africa.

ELAPHOGLOSSUM PREUSSII Hieron. Sanoquelle Dist.: Bilimu, *Harley F187.*

Seen on dead branches and mossy rocks, having probably fallen from trees. It grows in close association with *E. conforme*.

ACROSTICHUM AUREUM L. Montserrado Co.: Monrovia, *Cook 113, 114, Harley F117, Baldwin 11043, 11071.* Grand Bassa Co.: Grand Bassa, *Dinklage 1708, 1806, 2042, 2279.*

This species grows in tidal swamps and marshes, or among rocks on the seashore. It forms coarse tufts, 6 feet high.

PLATYCERIUM ANGOLENSE Welw. Sanoquelle Dist.: Sakimpa, *Harley F234.*

An epiphyte, this species is similar in habit to the more common *P. stemaria.* In this, the fertile fronds are obovate or cuneate, unforked; and the fertile area is roughly oval-shaped, at the terminal portion of the frond. It has been found near the northern border, and is said to be more common as one goes farther inland.

PLATYCERIUM STEMARIA (Beauv.) Desv. Montserrado Co.: Monrovia, *Cook 26, 116*; Muhlenburg, *Cook 117.* Boporo Dist.: Tawata, *Baldwin 10294.* Salala Dist.: Peatah, *Linder 1105.* Sanoquelle Dist.: Ganta, *Harley F16, F236.* Tchien Dist.: Gretown, *Baldwin 6740, 6961*; Zwedru, *Baldwin 7035, 7090*; north of Chensalar, *Winne 487.* Webo Dist.: Diebla, *Baldwin 6302.* Sine loc., *Dinklage s. n., Johnston s. n.*

Epiphytic on both upper and lower branches, in forest or partially open situations. This fern makes an impressive showing on the branches of its host. Masses of plants with old and new fronds may be 3 feet or more in diameter; and when knocked down with the accumulation of detritus attached, the weight of the mass is many pounds. Sterile fronds are paired and flattened against the host. The outer portions of these oval or reniform fronds are thin and papery; the central portions, more or less corky, up to three-eighths of an inch thick in the dry state, and capable of holding a great deal of moisture. These sterile fronds persist, those of several years overlapping, bound together by a firm network of rhizomes, gathering debris between and underneath the layers, the older, inner layers gradually decaying and adding their substance to the nutriment of the mass. Pairs of fertile fronds arise from the central point between the sterile ones, erect when young and vigorous, drooping with their own weight in the dry season. They are frequently 2 or 3 feet long. Each portion is twice forked, hence the popular name, "staghorn". Sori are in large V-shaped patches at the last forking.

PARKERIACEAE

CERATOPTERIS CORNUTA (Beauv.) Lepr. Montserrado Co.: sine loc., *Cook 154, 171* (coll. Mrs. Cook); Firestone Plantation, *Harley 1484.* Kolahun Dist.: Bolahun, *Earthy 38.* Gbanga Dist.: Gbanga, *Linder 545;* Suokoko, *Winne 259,* (coll. B. Traub). Sanoquelle Dist.: Gbeidin, *Harley F206, F211.* Tchien Dist.: Zwedru, *Baldwin 7046.*

In wet locations, open or partially shaded, such as drainage-ditches and choked stream-beds. During the rainy season, when the plants are frequently subject to complete and prolonged immersion, vegetative reproduction proceeds lushly. When the waters subside and the pools dry up, the old plants collapse in the muddy bed, and are eaten by small animals. Daughter-plants take root in the mud and may develop fruiting parts. All are very tender and easily broken. The colony at Gbeidin was intimately mixed with *Riccia fluitans.* The natives do not appear to make use of *Ceratopteris* as food, as reported in some countries.

There has been some question as to whether material from Africa represents a distinct species. Horn af Rantzien (1951) discusses the possibility that it is so, but prefers to include it under *C. thalictroides* in his discussion of Baldwin's Liberian collection, finding no significant dfferences from the Asiatic material. I act on Mr. Alston's authority in calling this *C. cornuta.* De Vol (1953) agrees with Mr. Alston. He writes, after seeing the specimens from Gbeidin: "The sterile fronds are quite different from *C. thalictroides* and your specimens are nearly identical to material collected by A. Peter in German East Africa."

GLEICHENIACEAE

GLEICHENIA LINEARIS (Burm.) Clarke. Montserrado Co.: near Monrovia, *Baldwin 5843;* Suey, *Cook 107;* Mt. Coffee, *Cook 153;* Firestone Plantation, *Linder 300.* Grand Bassa Co.: Grand Bassa, *Dinklage 1676, 2099.* Sanoquelle Dist.: Sanoquelle, *Winne 149;* Kitomu, *Harley F53.* Tappita Dist.: Tappita, *Winne 526.* Sine loc., *Whyte s. n., Millen s. n.*

Scandent on open banks, especially where the motor-road has been cut through. In my opinion, spreading inland from the coast along the road. In the places where it has begun to grow, it runs rampant, its repeatedly-divaricate branches giving rise to a tangled mass of vegetation.

SCHIZAEACEAE

LYGODIUM MICROPHYLLUM (Cav.) R. Brown. Montserrado Co.: near

Monrovia, *Baldwin* 5824, *Massey* 51, 78, *Skinner s. n.*, *Wingfield s. n.*, *Planer s. n.*; Mt. Coffee, *Cook* 149, 150; White Plains, *Cook* 103; Firestone Plantation, *Linder* 72. Grand Bassa Co.: Grand Bassa, *Dinklage* 1677, *Vogel* 3 (7/41). Maryland Co.: Harper, *Baldwin* 5992. Boporo Dist.: Boporo, *Cook* 73. Sanoquelle Dist.: Ganta, *Harley* F7, F219; Sanoquelle, *Winne* 32. Tappita Dist.: *Baldwin* 9086, *Winne* 523.

Terrestrial, climbing over weeds and shrubs in wet open places. It is particularly abundant along the edges of swamps, where its tangled masses contribute no little to the impenetrability of the thickets. In the dry season, the leaflets fall away from the thin wiry axes. Armfuls of this material are gathered by the natives for use in construction of stick-and-brush weirs, by which waters of small streams are diverted to their fish-traps.

LYGODIUM SMITHIANUM Presl. Montserrado Co.: Monrovia, *Massey* 64, *Planer s. n.*; Mt. Coffee, *Cook* 151. Maryland Co.: Firestone-Cavalla River Plantation, *Baldwin* 6019. Boporo Dist.: Beiten, *Baldwin* 10281; Fayapulu, *Linder* 1134. Salala Dist.: Piata, *Linder* 956. Gbanga Dist.: Bakratown, *Linder* 867. Sanoquelle Dist.: Ganta, *Harley* F6. Tappita Dist.: Tappita, *Harley* F145. Sine loc., *Sim s. n.*

Similar to the last in choice of habitat and manner of growth.

OSMUNDACEAE

OSMUNDA REGALIS L. Cape Mount Co.: Cape Mount, *Dinklage* 2583. Boporo Dist.: below Jui, at Mano River, *Bunting s. n.* (23/iv/10).

Terrestrial. As yet, collected only from the western border of the country.

MARATTIACEAE

MARATTIA FRAXINEA J. E. Smith. Montserrado Co.: Mt. Coffee, *Cook* 152; Firestone Plantation, *Linder* 250. Cape Mount Co.: Genne Tanyehun, *Baldwin* 10729. Grand Bassa Co.: Grand Bassa, *Dinklage* 1606. Sinoe Co.: Duo, *Baldwin* 11358. Boporo Dist.: Bomboma, *Linder* 1328. Kolahun Dist.: Kailahun, *Baldwin* 10144. Gbanga Dist.: Gbanga, *Linder* 455. Sanoquelle Dist.: *Harley* F34; Bilimu, *Harley* F69. Tappita Dist.: Tappita, *Winne* 496. Tchien Dist.: Gletown, *Baldwin* 6948. Webo Dist.: Diebla, *Baldwin* 6283; Palipo, *Baldwin* 6442; Yratoke, *Baldwin* 6242.

Terrestrial, in damp shade. In the more favorable locations, such as the bed of a mountain-stream, this fern forms great clumps, with arching cane-like fronds 10 or 12 feet overhead. The rachises are conspicuously marked with whitish lenticels, and

are swollen at each node. In less favorable situations, it grows 3-4 feet long.

OPHIOGLOSSACEAE

OPHIOGLOSSUM RETICULATUM L. Montserrado Co.: Mt. Coffee, *Cook* 47; Suey, *Cook* 61; Muhlenberg, *Cook* 97; Mt. Barclay, *Bunting* (16/ v/ 12); Firestone Plantation, *Harley F90*; Nikapu halftown, *Linder* 356; sine loc., *Cook* 405. Grand Bassa Co.: 12 miles inland from mouth of Cess River, *Baldwin 11245*. Sinoe Co.: Kulo, *Baldwin 11425*. Boporo Dist.: So-Banga, *Linder 1157*. Salala Dist.: Totota, *Baldwin 9167*. Sanoquelle Dist.: Ganta, *Harley F150*. Tchien Dist.: Chensalar, *Winne* 448.

Terrestrial, in sun or shade. It is possible that the collections listed above represent more than one species.

LYCOPODIACEAE

LYCOPODIUM CAROLINIANUM L. Montserrado Co.: Monrovia, *Linder* 33, *Dinklage* 2995; Paynesville, *Baldwin* 5845, *Harley F118*; Duport, *Linder 1454*. Grand Bassa Co.: Grand Bassa, *Dinklage 1820*. Sinoe Co.: Sasstown, *Baldwin 11609*.

Terrestrial, in coastal regions, especially in savannahs.

LYCOPODIUM CERNUUM L. Montserrado Co.: near Monrovia, *Dinklage* 2970, *Baldwin* 5842, *Massey* 49; White Plains, *Cook* 78; Muhlenberg, *Cook* 51; Mt. Coffee, *Cook 155, 156*; Firestone Plantation, *Baldwin* 5929, *Linder* 244; "70 miles up the St. Paul R.", *Reynolds s. n.* Grand Bassa Co.: Grand Bassa, *Ansell s. n.*, *Dinklage 1629*. Sinoe Co.: Sino Basin, *Whyte s. n.* (in 1904). Sanoquelle Dist.: Sanoquelle, *Winne* 33, 44; Ganta, *Harley F32*. Tappita Dist.: Tappita, *Baldwin* 9097. Sine loc., *Carder s. n.* (6/ 77).

Terrestrial, in open or partly open places, such as damp banks or the edge of swamps. It often pushes up through tangled growth of *Lygodium microphyllum* and *Selaginella myosurus* to a height of three feet.

LYCOPODIUM PHLEGMARIA L. (*Urostachys Warneckei* Hert.). Montserrado Co.: Firestone Plantation, *Linder 178*. Sinoe Co.: Kulo, *Baldwin 11401*. Grand Bassa Co.: Begwai, *Bunting 109*. Boporo Dist.: Boporo, *Cook 157, 486, 503* (coll. Straub); Bumbuma, *Linder 1346;* Kondesu, *Baldwin 10679*; Tawata, *Baldwin 10288*. Sanoquelle Dist.: Sanoquelle, *Baldwin 13138*; Bilimu, *Harley F71*, *Baldwin 12174*; Dubo, *Baldwin* 9498.

Epiphytic. It usually grows on the high branches of forest-trees, beneath which broken pieces of the lycopod may be found.

Because of its size (branches bristling with leaves may be 1½ inch in diameter, and hang 2 or 3 feet from the attachment), it is not so easily missed as some of the lofty-growing epiphytes.

PSILOTUM NUDUM (L.) Griseb. Grand Bassa Co.: across the Cess River from the town of River Cess, *Baldwin 11277.*

This plant was growing on a palm-tree.

SELAGINELLACEAE

SELAGINELLA CATHEDRIFOLIA Spring. Montserrado Co.: Suehn, *Linder 1399*; Mt. Coffee, *Cook 68, 86, 86B, 174.* Sinoe Co.: Duo, *Baldwin 11339*; Jurazon, *Baldwin 11452.* Boporo Dist.: Moala, *Linder 1378*; So-Banga, *Linder 1153*; on rock outcrop at Tawata, *Baldwin 10335.* Salala Dist.: Peahtah, *Linder 977.* Gbanga Dist.: Bakratown, *Linder 849.* Sanoquelle Dist.: Ganta, *Harley F19, F43*; Bilimu, *Baldwin 9576;* Kitomu, *Baldwin 13129, Harley F154*; Sopia, *Winne 131.* Webo Dist.: Webo, *Baldwin 6103A*; Mnanulu, *Baldwin 6025.*

On ground or rock in damp shade. Probably the most common of the smaller species of *Selaginella.* It grows decumbent on the forest-floor, mossy rocks, or clay-banks beside the path, rooting from any or all nodes along the course of the stem. It branches and, persisting from season to season, may form thick mats on the ground.

SELAGINELLA KALBREYERI Baker. Sanoquelle Dist.: Gban, *Harley F123* (coll. E. Brigfield); Sopia, *Baldwin 13133.*

Terrestrial, sometimes on rock-outcrops. Some of the branches are elongated, giving off roots along several inches of the terminal portion.

SELAGINELLA LEONEENSIS Hieron. Montserrado Co.: Monrovia, *Cook 173*; sine loc., *Cook 162.* Boporo Dist.: near Tawata, *Baldwin 10334.* Vonjama Dist.: Wohmen, *Baldwin 10068.* Gbanga Dist.: Gbanga, *Linder 445.* Sanoquelle Dist.: Bilimu, *Harley F108*; Kitomu, *Harley F161.*

This species grows in damp locations, such as boulders on the side of a stream. It is 2-3 inches tall, with rather short lateral branchlets, more or less erect, and of a rather light shade of green.

SELAGINELLA MOLLERI Hieron. Montserrado Co.: Monrovia, *Cook 173A.* Boporo Dist.: Banga, *Linder 1181.* Gbanga Dist.: Gbanga, *Linder 444.* Sanoquelle Dist.: Ganta, *Harley F137;* Kitomu, *Harley F156*; Sanoquelle, *Baldwin 13132.* Tappita Dist.: Tappita, *Baldwin 9103.* Webo Dist.: Diebla, *Baldwin 6288.*

Terrestrial, on wet banks and forest-floor. A suberect plant,

6-8 inches tall; dark-green; the lower branches the longer, giving a deltoid outline to the plant; roots arising from nodes along the lower third of the stem.

SELAGINELLA MOLLICEPS Spring. Montserrado Co.: Mt. Coffee, *Cook 69, 83, 86A.* Sanoquelle Dist.: Bilimu, *Harley F196.* Tchien Dist.: Satro Mt., *Winne 475.*

Very similar in habitat and habit to the preceding species, it is perhaps less regular in its branching. Both species die back during the dry season. They are distinguished in the herbarium by the shape and ciliation of the median leaves.

SELAGINELLA MYOSURUS (Swartz) Alston. (*S. scandens* Spring). Montserrado Co.: Monrovia, *Planer 534, Watt* and *Skeen s. n., Massey 51, 56, 71, Skinner s. n., Dinklage 2473, 2807, Baldwin 5809, 13012;* Bushrod Is., *Winne 18;* Mt. Coffee, *Cook 94, 161, 379;* Firestone Plantation, *Cooper 42;* Port Marshall, *Knudsen 6.* Cape Mount Co.: Jabrocca, near Fisherman's Lake, *Baldwin 10855.* Grand Bassa Co.: Grand Bassa, *Anseli s. n.* Sinoe Co.: Sino Basin, *Whyte s. n.* Maryland Co.: Cape Palmas, *Schoenlein s. n.*; Harper, *Baldwin 5969.* Boporo Dist.: Zuie, *Baldwin 12091.* Kolahun Dist.: Bolahun, *Earthy 17 p. p.* Gbanga Dist.: Gbanga, *Linder 446.* Sanoquelle Dist.: Ganta, *Harley F17, F37;* Sanoquelle, *Baldwin 13134, Winne 94.* Tchien Dist.: Gretown, *Baldwin 6746;* Zeahtown, *Baldwin 6926.* Webo Dist.: Webo, *Baldwin 6216.*

Kuhn (1868) cites a specimen from Liberia under the name of Arnott. Arnott appears never to have visited West Africa himself, but to have built up his herbarium by a good deal of exchange, so that this specimen was probably collected by someone else, perhaps someone in Vogel's party.

Terrestrial, climbing over grass and shrubs in many situations, and in all parts of the country. It is one of the two or three most common species. Under certain conditions of soil or moisture, the plant has a definite blue-green color. The slender climbing stems are straw-colored. Leafless branches, arising from many nodes, in addition to leafy branches, seem to serve the purpose of tendrils for support, and are also capable of taking root at their tips.

SELAGINELLA SOYAUXII Hieron. Kolahun Dist.: Bolahun, *Earthy 17 p. p., misc. i.* Sanoquelle Dist.: Bilimu, *Harley 2098.*

Terrestrial. This species is closely related to *S. molliceps, S. Molleri,* and *S. leoneensis.* It is distinguished in the field by its

larger size, reaching a length of 12 inches or more. It is not common.

SELAGINELLA SUBCORDATA A. Braun. Montserrado Co.: Paynesville, *Harley F209*. Boporo Dist.: Tawata, *Baldwin 10348*. Sanoquelle Dist.: Sakimpa, *Winne 77*.

Terrestrial. The specimen from Paynesville was growing under a tree at the edge of a savannah-area; at Tawata it was found on a rock-outcrop; Winne's was in red earth on a shaded bank in the forest. It is the smallest of this *S. molliceps* group, standing about 2 inches tall. Lateral branches are often simple and short, the fruiting portion of 5 mm. sometimes making up half the entire length of the branch.

SELAGINELLA VERSICOLOR Spring. Montserrado Co.: Mt. Coffee, *Cook 52, 175*. Sinoe Co.: Jurazon, *Baldwin 11454*. Boporo Dist.: Totokweli, *Linder 1293*; So-Banga, *Linder 1152*. Kolahun Dist.: Bolahun, *Earthy 21*. Vonjama Dist.: Wohmen, *Baldwin 10098*. Sanoquelle Dist.: Ganta, *Harley F22, F23, F231*; Kitomu, *Harley F160, F162*; Bilimu, *Harley F107, F197*; Bobei, *Winne 163*. Tchien Dist.: Satro Mt., *Winne 468, 476*. Webo Dist.: Webo, *Baldwin 6101*; Diebla, *Baldwin 6287*.

A species of the forest-floor. It roots only from the lower nodes. Young plants are almost decumbent, but older individuals become erect by elongation of the unbranched lower portion of the stem, achieving a habit that simulates that of *S. Vogelii*. This species largely disappears during the dry season. It differs from the other species in the light silvery-green color of the under surface of the frond. Branches do not lie in one plane and are brittle, so that it is hard to flatten out for drying.

SELAGINELLA VOGELII Spring. Montserrado Co.: Mt. Coffee, *Cook 104, 172, 391, 105, 160, 499*, coll. Straub. Cape Mount Co.: Cape Mount, *Dinklage 2560*. Sinoe Co.: Sino, *Whyte s. n., Sim s. n.* Boporo Dist.: Boporo, *Cook 63*; Zuie, *Baldwin 12090*. Gbanga Dist.: Yangi, *Linder 850*. Sanoquelle Dist.: Ganta, *Harley F22A*; Kitomu, *Harley F160A*; Bilipia, *Harley F115*; Bobei, *Winne 165, Harley F232*. Tappita Dist.: Tappita, *Winne 492*. Webo Dist.: Diebla, *Baldwin 6287A*; Mnanulu, *Baldwin 6059*.

Terrestrial, usually in deep forest. This is a persistent species, with an erect "stipe" 6-8 inches long, and a spreading deltoid lamina-like upper portion. The lower parts of the axis are often pink-tinged, the upper frond a deep-green, rather showy. The fronds are sometimes eaten by something (Cook noted that it was

snails). The leaves tend to roll in drying, so that the fronds in herbarium-specimens have lost the even, textured appearance of the living plant. — **Ganta Methodist Mission, Ganta, Liberia.**

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